

# **Anonymous job application and discrimination**

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## **Abstract:**

Anonymous job application is a policy measure which aims to eliminate discrimination during the job assignment process by concealing personal characteristics of applicants from employers. This paper provides evidence of discrimination and the effectiveness of anonymous job application with respect to the invitation for a job interview on the basis of two experiments in Nijmegen. This evidence is especially founded on an analysis in which the same groups of departments of the public sector of Nijmegen with and without anonymous job application are compared. Anonymous job application always results in non-discriminatory decisions of employers with respect to the invitation of the applicants for a job interview. There is neither in the groups with anonymous job application, nor in the other groups evidence of discrimination with respect to the hiring of the applicants, which takes place after the job interview. According to those results the discriminatory behavior of employers with respect to the invitation for a job interview is only explainable by theoretical models of statistical discrimination and anonymous job application always eliminates discrimination during the whole job assignment process. There is no convincing evidence of negative effects of anonymous job application on the efficiency of the application procedures in the short term. Finally, the evidence of ‘hidden discrimination’, revealed by ‘over-qualified’ immigrant applicants, shows that the effects of anonymous job application are even larger.

## **Keywords:**

Anonymous job application, ethnic discrimination, economic policy

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## 1. Introduction

*The 25-year old Dutch business economist Özlem Coban completed HBO<sup>1</sup>, took a university degree and did her work placement in London, but never felt to be an ‘immigrant’, until two years ago. She became suspicious after sending more than 40 letters of application for seven months without ever receiving an invitation for a job interview. She was afraid that her name could be the reason of the rejections. To take away her own concerns, because she could not really believe her non-western sounding name to be the cause, she signed her next five letters of application with the name ‘Suzan Coban’, she only changed her first name. After that she received three invitations for an interview, but after none of the interviews she was hired for the job (Van Paassen, 2006).*

This example indicates that discrimination on the basis of an applicant’s name, which often reveals his or her ethnicity, may be a problem in the Dutch labor market, but also in other western labor markets. Some employers do not like immigrant workers at all, others expect them to be less productive. Discrimination occurs in the labor market if equally productive persons who provide labor market services are treated unequally in a way that is related to an observable characteristic which is unrelated to productivity (Altonji and Blank, 1999). Examples of this ‘observable characteristic’ are gender, ethnicity or age. The unequal treatment becomes evident in lower wages or a lower probability to be invited for a job interview or to be hired during a job assignment process. Another possibility is ‘hidden discrimination’, in that case certain persons adapt their behavior because they expect to be discriminated.

Discrimination in the labor market is a persistent problem in many western countries (Rich and Riach, 2002). Bertrand and Mullainathan (2004) show evidence of discrimination in the US; Bovenkerk, Gras and Ramsoudh (1995) and Andriessen, Dagevos, Nievers and Boog (2007) do this for the Netherlands. Like in almost all western countries discrimination is forbidden by law in the Netherlands. As a consequence wage discrimination is less likely, because it is relatively easy for the authorities to control the wages of different groups of workers. Discrimination during the job assignment process is more subtle and occurs frequently in the (Dutch) labor market (Andriessen, Dagevos, Nievers and Boog, 2007). Especially non-western immigrants are discriminated when they apply for a job.<sup>2</sup> According

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<sup>1</sup> Higher Vocational Education, in Dutch: “Hoger Beroepsonderwijs”.

<sup>2</sup> From now on I call non-western immigrants simply immigrants, because western immigrants are usually not discriminated (see section 2.2). In the Netherlands this group of people is often called ‘allochtonen’, in section 2 and 4 I discuss this definition more extensively.

to the literature immigrants are *ceteris paribus* significantly less often invited for a job interview and significantly less often get the job.<sup>3</sup> The subject of research of this thesis, the Dutch experiment with the anonymous job application policy measure, aims to prevent discriminatory behavior of employers / recruiters during the job assignment process.

Anonymous job application is a way to force employers / recruiters to apply a color-blind hiring policy, because it prevents the observation of the applicants' ethnicity during the first phase of the job assignment process. Under an anonymous job application policy workers send their CV and letter of application for a certain job opening, but before employers assess the different CVs and letters of application an independent institution removes the personal information about the applicants which directly reveals certain characteristics. If the aim is to conceal the ethnicity of applicants from the employers, information like the name, place of birth, nationality, country of origin and e-mail address of the applicants are removed.<sup>4</sup> Employers / recruiters assess the adapted letters of application and invite the best applicants for an interview. In this way discrimination during the job assignment process should be prevented. Of course the concerning personal information is no longer hidden during and after the job interview.

Affirmative action is empirically and theoretically the most assessed policy measure which aims to eliminate discrimination in the labor market. Affirmative always gives preferential treatment to groups over others. In line with this affirmative action is especially appropriate to eliminate differences between groups in characteristics valued by the labor market caused by discrimination in the past (Loury, 1987). Affirmative action is a policy measure broader in scope than anonymous job application, because anonymous job application cannot compensate (if desired) for discrimination in the past, it only enforces a color-blind hiring policy. However, contrary to anonymous job application affirmative action may also result in reverse discrimination, for example by requiring a certain number or proportion of minority group workers. According to Coate and Loury (1993a and 1993b) affirmative action may even result in a worse position of minority group workers, in that case what they call a 'patronizing equilibrium' arises. Another advantage of anonymous job application is the enforcement, which is easier and more transparent than the enforcement of most affirmative action policies. With respect to the job assignment process a way to put

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<sup>3</sup> See for example: Riach and Rich (2002), Carlson and Rooth (2007) and for the Netherlands: Gras, Bovenkerk, Gorter, Kruiswijk and Ramsoudh (1996) and Dolfing and Van Tubergen (2003).

<sup>4</sup> Under these conditions the experiment is put into practice in Nijmegen. The other Dutch experiments took place under similar conditions.

affirmative action into practice is requiring a representation of hired minority group workers proportionally with their representation in the pool of qualified workers. Enforcing this policy is a lot more difficult than introducing anonymous job application.<sup>5</sup>

The effectiveness of policies which aim at the elimination of discrimination, like anonymous job application, is economically relevant because discrimination reduces the productive and allocative efficiency in most circumstances.<sup>6</sup> Workers' incentives to invest are distorted and not the most productive workers are allocated. With the assistance of the theoretical models of discrimination in section 3 I explain the effects of discrimination in the labor market more extensively. Besides that the positive and negative side effects of anonymous job application are important, like the effect on the efficiency of the application procedures and the effect on the applicants' expectation to be discriminated or not.

Eliminating discrimination is socially relevant because the existence of discrimination in the labor market results in group inequality. Group inequality is morally an undesirable situation because in that case certain groups of workers are disadvantaged by birth. Interracial tensions may be the result. Especially in the US discrimination (in the past) has created large group inequality between African Americans and White Americans, but also in some European countries labor market discrimination is a problem.<sup>7</sup> That is why discrimination is forbidden by law in almost all Western countries.

The purpose of this research is to provide a better understanding of the direct consequences and the ability of the anonymous job application policy measure to eliminate discrimination in the labor market during the job assignment process. On the basis of two Dutch experiments with the anonymous job application policy measure, which have taken place in Nijmegen between 2006 and 2008, the effects of anonymous job application are empirically investigated. This research contributes to the existing empirical literature on discrimination in the labor market and especially to the literature on anonymous job application. In section 2 the main related literature is discussed. In contrast to other studies about anonymous job application the dataset of the experiments in Nijmegen allows me to investigate the effects of anonymous job application while the applicants do not know

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<sup>5</sup> For example Lundberg (1991) discusses theoretical problems with respect to enforcing affirmative action.

<sup>6</sup> See for example Arrow (1973), Lundberg and Startz (1983) and Coate and Loury (1993a and 1993b).

<sup>7</sup> Especially originally immigrated minority groups suffer from a discriminatory treatment in the labor market in these countries. In the Netherlands for example workers who are originally from Morocco have a disadvantaged position if they apply for a job (Andriessen, Dagevos, Nievers and Boog, 2007).

whether their personal characteristics are concealed from the employers / recruiters or not.<sup>8</sup> This prevents applicant selection effects. Another advantage is that the dataset contains information about the whole job assignment process. Finally, the fact that two experiments have taken place within a reasonably short time period with the same experiment groups, allows me to compare the results with and without anonymous job application of the same experiment groups (same groups of departments). This is a unique feature of the dataset which is essential to draw reliable conclusions about the effects of anonymous job application on the discriminatory behavior of employers / recruiters, because only in this way the behavior of the same employers / recruiters is investigated. With respect to the evidence of discrimination in the labor market this research shows whether immigrant applicants have a lower probability to be invited for an interview or to be hired. An advantage compared to a lot of other empirical articles which investigate discrimination during the job assignment process is that real applicants and real job openings are investigated. Because the proportion of (recent) immigrant habitants is reasonably large in the Netherlands this research is able to give a clear view on the effects of discrimination and anonymous job application.<sup>9</sup>

I have found significant evidence of discrimination during the job assignment process in (part of) both groups of investigated departments during the first phase of the job assignment process. In the first group of departments immigrants have a 18% lower probability to be invited for a job interview on the high job level. In the second group of departments immigrants have a 9.3% lower probability to be invited, immigrants have a 7.7% lower probability to be invited on the low job level of this group of departments. The anonymous job application policy measure always reduces the effect of discrimination during the job assignment process, but not always significantly. In the first group of departments anonymous job application significantly reduces the reverse discrimination on the low job level with 10.3% and in the second group of departments anonymous job application significantly reduces the discrimination of immigrants with 10.3%. The introduction of anonymous job application always results in a non-discriminatory first phase of the job assignment process. There is no evidence of discrimination during the second phase of the job application process. As a consequence the effect of anonymous job application on immigrants' chances is not significant in this phase of the job assignment process. The final result of introducing anonymous job application is a non-discriminatory job assignment process. The anonymous

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<sup>8</sup> This refers to the articles discussed in section 2.3.

<sup>9</sup> I come back to this in section 4.1.

job application policy measure hardly influences the efficiency of the application procedures. The observation of the applicants' productivity by employers / recruiters is significantly noisier on the low job level of the second group of departments, but there is no effect on the high job level and in the other group of departments. The number of interviews increases significantly only for the second group of departments on the total level, but not on the different job levels. Finally, there is significant support for the proposition that immigrant applicants are more often 'over-qualified', which indicates 'hidden discrimination'. This implies that the effects of a permanent anonymous job application procedure are even larger.

The remainder of this thesis is outlined as follows. Section 2 presents a literature review, in which the existing empirical literature with respect to labor market discrimination and anonymous job application are discussed. In section 3 I give a short review of the basis models of taste-based and statistical discrimination, the two strands of theoretical models of discrimination. Section 4 gives general background information about the anonymous job application policy measure and the experiments in Nijmegen. I continue with section 5, in which the properties of the dataset of the experiments in Nijmegen are discussed. After that section 6 explains and discusses the empirical analysis. The results from this empirical analysis are presented by the seventh section. Finally I end the paper with a conclusion.

## **2. Literature review discrimination and anonymous job application**

In this section I discuss the empirical literature with respect to discrimination in the labor market, especially during the job assignment process. In the first section I discuss the empirical literature on discrimination in the labor market from western countries in general, while the second section is concentrated on the Dutch labor market. The third section treats the existing empirical literature about the effectiveness of the anonymous job application policy measure in the labor market and other measures which 'blindfold' the persons who decide during an application procedure.

### **2.1. Discrimination in the western labor markets**

In this section I discuss a few important and recent empirical articles about discrimination in the labor market. I start with briefly discussing the research designs and outcomes of the concerning empirical articles. After that possible similarities or differences in comparison with the anonymous job application experiments in Nijmegen are discussed.



Two main types of studies have been used to directly test the extent of discrimination in the labor market (Altonji and Blank, 1999), correspondence tests and (personal) audit tests.<sup>10</sup> I concentrate on correspondence and audit testing because those methodologies are able to indicate discrimination during the job assignment process, contrary to for example a decomposition of wage differentials.<sup>11</sup> The first approach, correspondence testing, implies that researchers send equal (often fictitious) letters of application and CVs to advertised job openings with the only difference being the research variable, often the ethnicity or gender of the applicant. After that the researchers investigate the differences in the probability to be invited for an interview between the two research groups. Under the second approach, audit testing, two comparable auditors are matched, one from both groups. Both auditors are sent to an interview, after which the researchers investigate whether the auditors of the majority group get the job more often. Heckman (1998) highlights a few important weaknesses of the latter method. First, to get reliable results both auditors have to be identical in all dimensions which employers expect to influence their productivity, which is very unlikely. Second, the procedure is not double-blind, the auditors know the purpose of the study which may bias the results. Finally, audit testing is very expensive. Those weaknesses are solved by using (fictitious) correspondence testing, but in that case still the problem arises that informal channels for job search, like social networks, are excluded (Heckman and Siegelman, 1993).

Bertrand and Mullainathan (2004) investigated discrimination on the basis of applicants' names during the first phase of the job assignment process in Boston and Chicago. During the first phase of the job assignment process applicants send a letter of application, after which the employers / recruiters decide which applicants are invited for an interview. Bertrand and Mullainathan (2004) expected employers to use the applicants' names as a signal of their ethnicity. They put their field experiment into practice by sending fictitious resumes in response to help-wanted ads. They randomly assigned very White sounding and very African American sounding names to the fictitious resumes and measured the total number of callbacks for both groups. This is a form of fictitious correspondence testing. Bertrand and Mullainathan (2004) have found a statistically significant lower callback rate for applicants with African American sounding names, they are 50% less likely to be called for a job

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<sup>10</sup> American researchers call those studies 'audit tests', while British researchers call them 'situation tests'. In the Netherlands they are called 'praktijktesten'.

<sup>11</sup> Other methods to assess discrimination in the labor market are a wage decomposition analysis (see for example Oaxaca (1973), Oaxaca and Ransom (1994), Blau and Ferber (1987) or Card and Lemieux (1996)) or directly estimating the marginal products of workers of different groups and compare the relative wages (see for example Hellerstein, Neumark and Troske (1996)).

interview than applicants with a White sounding name. A similarity with the experiment in Nijmegen is the expectation that employers use the applicants' name as a signal of their ethnicity. Important differences are the research method and the fact that fictitious resumes are used, the dataset of the experiments in Nijmegen contains application procedures of real applicants for real job openings. This implies that a real situation is investigated, but also that other (hidden) applicant characteristics may influence the outcomes. Another difference is the sector, the experiment of Bertrand and Mullainathan (2004) is performed in the private sector, contrary to the experiments in Nijmegen. Finally, in contrast to the experiments in Nijmegen the research of Bertrand and Mullainathan (2004) treats only the first phase of the job assignment process.

Carlsson and Rooth (2007) also applied fictitious correspondence testing to investigate possible ethnic discrimination in the Swedish labor market. They randomly assigned native sounding and Middle-Eastern sounding names to fictitious resumes and sent them to real job openings in Gothenburg and Stockholm. For the latter group they have found a 10% lower callback rate for an invitation for an interview, which results in a relative outcome very similar to Bertrand and Mullainathan (2004), the relative callback rate is 50% lower for applicants with Middle-Eastern sounding names. The experiment of Carlsson and Rooth (2007) is very similar to that of Bertrand and Mullainathan (2004), so the same differences and similarities with the experiments in Nijmegen arise. Carlsson and Rooth (2008) applied correspondence tests similar to their previous research, except for the groups of applicants. In this research they included three groups of applicants in the resumes: native workers, native workers with Middle-Eastern sounding names and workers immigrated from Middle-Eastern countries. They have found a 17% lower callback rate for native applicants with a Middle-Eastern sounding name and a 21% lower callback rate for the immigrated applicants, both compared to native applicants. On the basis of those results they conclude that the foreign name of the applicants explains 77% of the discrimination by employers during the job assignment process, while the other 23% is explained by the foreign qualifications of applicants. This supports the assumption that employers / recruiters especially found their discriminatory behavior on the applicants' names. Contrary to the experiments in Nijmegen Carlsson and Rooth (2008) separated the effect of the 'sounding' of the name and real immigrated workers, the other characteristics of the research are similar to Carlsson and Rooth (2007).

Riach and Rich (1991) applied correspondence tests in Victoria, the most densely populated Australian state. They investigated possible discrimination of two recent immigrant groups, the Greek and the Vietnamese immigrants. They compared those groups with the predominantly Anglo-Celtic population. Two standard letters of application were used for the correspondence tests and the candidates were carefully matched. The only effective distinguishing characteristic was ethnicity, all other characteristics, like age, qualifications and experience were similar. A similarity with the experiments in Nijmegen is that the results are based on real applicants. Different are the research method, the definition of immigrants, which is not based on the applicants' names, and the sector which is investigated, the private sector. In this research always two applicants are compared, contrary to the fictitious correspondence tests. Riach and Rich (1991) have found a net rate of discrimination of 24.6% against the Vietnamese immigrants and a net rate of discrimination of 8.8% against Greek immigrants. Those rates indicate the percentage of cases in which the immigrant group applicant is discriminated minus the cases in which the native applicant is discriminated. Both effects are statistically significant.<sup>12</sup>

Riach and Rich (2002) surveyed a lot of audit tests which investigated discrimination on the basis of the applicants' ethnicity. They conclude on the basis of those studies, which have been conducted over 30 years and in 9 western countries,<sup>13</sup> that there is significant, persistent and pervasive discrimination in the labor market with respect to non-whites.<sup>14</sup>

Eriksson and Lagerström (2007) did research to the occurrence of discrimination in the Internet-based CV database of the Swedish Public Employment Office. They investigated the number of contacts the job seekers received and whether applicants who received more contacts from firms have a higher probability to be hired. Eriksson and Lagerström (2007) have found evidence of significant lower contract rates for job seekers with a non-Nordic

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<sup>12</sup> Turner, Fix and Struyk (1991); Cross, Kenny, Mell and Zimmerman (1990) and James and DelCastillo (1991) did very similar research in the US: in Chicago (5.1% blacks/whites, 16.2% Hispanics/Anglos), Washington (13.1% blacks/whites), San Diego (13.1% Hispanics/Anglos) and Denver (6.3% Hispanics/Anglos, -3.5% blacks/whites). In the parentheses I mention the net rates of discrimination of the minority group applicants. Except for the black/white rate in Denver they have all found discrimination of the ethnic minority group. I do not discuss those studies in the main text because I have already discussed the article of Bertrand and Mullainathan (2004) about discrimination in the US, which is based on more recent data.

<sup>13</sup> Countries in Europe, North America and the Pacific, which are all members of the OECD. The Netherlands are also included, the evidence of Bovenkerk, Gras and Ramsoudh (1995) is discussed.

<sup>14</sup> They conclude the same with respect to females and disabled workers. Besides that the discrimination also arises in the housing and product markets, but those are no subject of analysis in this research.

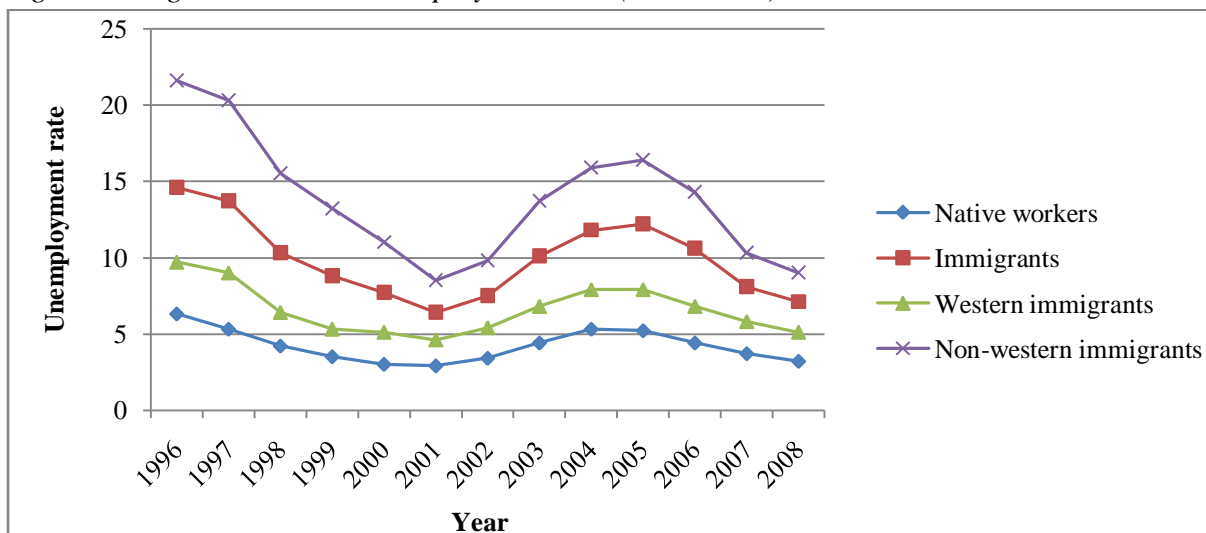
sounding name, for older job seekers and for unemployed job seekers. They also conclude that job seekers with higher contact rates have a significant higher probability to be hired. In contrast to the previously discussed articles, in this article real job search is investigated, with a very large sample (18,167 job seekers). However, a disadvantage of using an Internet database is that it probably not perfectly represents the whole labor market. The experiments in Nijmegen are also based on real job seekers / applicants, but the data is not based on an Internet database, as a consequence the number of observations is also much smaller. In this research the ethnic groups are again defined by the ‘sounding’ of the name of the applicant, like in the experiments in Nijmegen. Both experiments are performed in the public sector.

I conclude that according to the existing empirical literature there is a lot of direct evidence of discrimination on the basis of the applicants’ ethnicity during the job assignment process in the western labor markets. In the next section I discuss the empirical literature with respect to labor market discrimination of ethnic minorities in the Netherlands, to illustrate the Dutch situation.

## 2.2 Discrimination in the Dutch labor market

In this section I concentrate on discrimination during the job assignment process in the Dutch labor market. I start with some empirical information in *figure 1*, the Dutch unemployment rate, specified to the various groups of workers.

Figure 1: Registered Dutch unemployment rate (1996-2008)



Source data: [www.cbs.nl](http://www.cbs.nl)

The figure shows lower unemployment rates for native workers than for immigrant workers. The specification to western and non-western immigrants indicates that especially non-western immigrants are more often unemployed. Those differences between the population

groups may have several causes besides discriminatory behavior of employers, like a lower level of education, a limited command of the Dutch language or the lack of a social network outside their own group (Van Tubergen, 2006). However, a decomposition-analysis<sup>15</sup> of the SCP<sup>16</sup> (Andriessen, Dagevos, Nievers and Boog, 2007) indicates that after controlling for age, gender, education level, the command of the Dutch language, a Dutch education and individual factors, non-western immigrant workers still have a higher probability to be unemployed than native workers. This difference indicates discrimination during the job assignment process.

Like already discussed in the previous section, audit and correspondence tests are also used in the Netherlands to investigate discrimination during the job assignment process. According to several publications of Bovenkerk, who applied correspondence and personal audit tests to investigate discrimination of immigrants, immigrant applicants are significantly less often invited for a job interview and significantly less often hired than similar native applicants in the Netherlands.<sup>17</sup> Bovenkerk, Gras and Ramsoudh (1995) show a minimum net rate of discrimination during the first phase of the job assignment process of 32% for low educated male applicants from Moroccan origin and a rate of 40% for the same group of applicants from Surinam origin. In both cases audit tests are applied.<sup>18</sup> For the high educated male applicants from Surinam origin they have found a minimum net rate of discrimination of 18%, by applying correspondence tests.<sup>19</sup> All those effects are statistically significant.

Dolfijn and Tubergen (2005) investigated discrimination in the search for a work placement on the MBO level in the Netherlands. They applied personal audit tests by phone to test this. The applicants (auditors) did not use their own name during this telephone conversation, but a very Moroccan or Dutch sounding name, for all phone calls the same names were used. The auditors who used the Moroccan sounding names were from Moroccan origin and the auditors who used the Dutch sounding names were from Dutch origin. All the applications were unsolicited. Dolfijn and Tubergen (2005) have found that immigrant MBO students from Moroccan origin are rejected 1.6 times more often than native MBO students. The specification to the different sectors shows that discrimination is statistically significant in most sectors and most severe in the building sector.

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<sup>15</sup> In line with the method used by Oaxaca (1973).

<sup>16</sup> The Dutch Social Cultural Planning Agency, in Dutch: Sociaal Cultureel Planbureau.

<sup>17</sup> See Bovenkerk (1978), Bovenkerk, Gras and Ramsoudh (1995) and Bovenkerk, Gras, Gorter, Kruiswijk and Ramsoudh (1996).

<sup>18</sup> The first sample contained 175 auditors and the second sample contained 102 auditors.

<sup>19</sup> This sample contained 157 letters of application.

Beek (1993) analyzed which characteristics of applicants are the most important for employers. This analysis is based on a research method in which employers have to sort different fictitious CVs according to their preferences.<sup>20</sup> A large disadvantage of this research method is that employers have to behave as if they are searching for a (low skilled) employee. This decreases the reliability of the results, because they may behave differently in reality.<sup>21</sup> In spite of that having the immigrant ethnicity turned out to have a negative effect in this research. De Graaf-Zijl, Berkhout, Hop and De Graaf (2006) used a similar research method, but conclude that ethnicity plays a minor role. However, they have found a negative effect of characteristics which are common for immigrant applicants, like a poor command of the Dutch language and not eyeing the recruiter during a job interview. The conclusions of this research encountered a lot of opposition, especially after the pronouncement of the former Dutch minister of Economic Affairs (Joop Wijn), in which he stated that discrimination plays no role in the disadvantaged position of immigrant workers in the Dutch labor market (Van Rijswijk, 2006). Jaspers and Lubbers (2007) reacted by writing an article on the basis of the other empirical literature about the Dutch labor market in which they argue that the conclusions of Graaf-Zijl, Berkhout, Hop and De Graaf (2006) are unreliable, especially due to the research method, which is already discussed with respect to Beek (1993).<sup>22</sup>

Empirical research also shows a lot of negative opinions of the Dutch people about immigrant workers. Around the 20% of the Dutch population has strong negative stereotypes about immigrants (Scheepers, Eisinga and Linssen, 1994). Even a larger part of the Dutch population, 48%, has 'subtle' (less strong) negative stereotypes about immigrants (Verberk, Scheepers and Felling, 2002). Kruisbergen and Veld (2002) investigated the opinion of employers about young immigrant workers. They have found that 6% of the employers would never fill a vacancy with an immigrant worker, 18% would only hire an immigrant worker if no native workers apply. Those studies indicate the existence of negative stereotypes of

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<sup>20</sup> In Dutch this method is called 'vignettenanalyse'.

<sup>21</sup> Pager and Quillian (2005) for example show this, they have find significant differences between the outcomes of a survey and audit tests, both aimed at the existence of discrimination during the job assignment process.

<sup>22</sup> The unreliability of the conclusions is especially caused by the research method, which assumes that employers behave in reality the same as in the experiment. Another factor which plays a role is that the research design is not able to isolate the effect of discrimination in application procedures, as discussed in the main text some characteristics which have a negative effect are very common for immigrants. One of the authors (De Graaf-Zijl) admitted this in a radio interview (Source: NRC Handelsblad, November 7, 2006)

employers about immigrant workers. An important disadvantage of assessing the opinion of employers on immigrants is that their opinion does not have to reflect their real behavior.<sup>23</sup>

There is also empirical evidence of a higher probability of immigrants to be employed at a 'low level job', which may indicate discrimination. Besides discrimination other factors may also play a role, like social networks and residential segregation. Langenberg and Lautenbach (2007a, 2007b) merged the data of four EBBs,<sup>24</sup> which are compiled by the CBS,<sup>25</sup> and assessed the differences in average job level between native and non-western immigrant workers. The results show reasonably large differences between native workers and the non-western immigrants (specified to: Turkish, Moroccan, Surinam, Antillean and other non-western origin). After controlling for education, age, gender and urbanization the differences become smaller, especially for workers who are originally from the Antilleans, but the gap does not disappear and stays reasonably large for the workers from Moroccan and Turkish origin. Dagevos and Bierings (2005) also did research to whether immigrants have a higher probability to be employed at the low job levels. They used a logistic regression analysis to investigate the data of the EBB'03<sup>26</sup> and controlled for age, education, gender, family composition and the age of the workers' children. They conclude that workers from Surinam origin are overrepresented at the low level jobs due to differences in control factors like age and education. However, for the other groups (Moroccan, Turkish, Antillean and other non-western immigrants) the probability to be employed at a low level job is significantly higher, also after controlling for the applicants' characteristics.

The last way to assess discrimination is by the opinion of the discriminated groups of workers, in this case the immigrant workers. According to Manpower<sup>27</sup> (2007) 45% of the immigrant workers indicates to have to do more than native workers to be hired for a job. Klaver, Mevissen and Odé (2005) show that according to 63% of the MBO and HBO students immigrants are discriminated in the labor market. A survey with a sample of 300 Moroccan, Turkish and Surinam workers<sup>28</sup> showed that 82% agreed with the proposition that native applicants are preferred to immigrant applicants during the job assignment process (Nederlands Centrum Buitenlanders, 1995). A disadvantage of this way of assessing

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<sup>23</sup> See also footnote 21.

<sup>24</sup> Inquiry labor force, yearly set up by the Dutch statistical bureau, in Dutch: Enquête beroepsbevolking.

<sup>25</sup> Dutch statistical Bureau, in Dutch: Centraal Bureau voor Statistiek.

<sup>26</sup> Inquiry labor force 2003, see footnote 24.

<sup>27</sup> Manpower is a Dutch employment agency.

<sup>28</sup> The largest non-western immigrant groups in the Netherlands.

discrimination is the correctness of the experiences of immigrants, they may blame too much rejections to discriminatory behavior of employers.

I conclude that there is convincing evidence of discrimination on the basis of ethnicity in the Dutch labor market. The opinion of immigrants, the opinion of employers about immigrants, the higher probability to be employed at low job levels and experiments (like audit and correspondence tests) show this. On the basis of this conclusion I expect to find evidence of discrimination in the labor market of Nijmegen, despite the fact that the degree of discrimination probably differs between the different education levels, sectors and regions of the country.

### **2.3 Anonymous job application**

Like already discussed the purpose of anonymous job application is to eliminate discrimination during the job assignment process. At this moment the empirical evidence of the effectiveness of anonymous job application procedures is limited. This is caused by the fact that anonymous job application procedures are not widespread in the western labor markets yet. Another factor which plays a role is the lack of detailed data.<sup>29</sup>

Goldin and Rouse (2000) investigated a procedure which conceals the gender of applicants during the audition procedures of the five highest ranked symphony orchestras in the US, to prevent discriminatory behavior against women. The identity of the applicants was hidden by doing the auditions behind a screen. The auditions consisted of several rounds: the preliminary rounds, the semifinal round and the final round. Almost all preliminary rounds were 'blind' in terms of Goldin and Rouse (2000), while final rounds only were blind by exception. The procedure in the semifinals varied. The procedure increased the probability to be advanced out of a preliminary round by 50% for female applicants, but also increased the likelihood that a female applicant wins the final round and is hired by 30%. So Goldin and Rouse (2000) have found evidence that a 'blind' procedure in the preliminary round not only influences the outcome of the concerning round, but also the result of the final round, in which the applicants are not behind a screen. An advantage of the dataset of the experiments

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<sup>29</sup> The anonymous job application procedures in Belgium are an example of this. The Federal Government's recruitment agency, Selor, applies an online anonymous job application procedure, but there is no evidence about the effectiveness of this procedure due to the fact that there is no definition of immigrants on the Belgian federal level. As a consequence it is not possible to measure the results on the required level. Source: press release Selor October 30, 2008, "*Selor garandeert objectieve contractuele selectieprocedures voor de federale overheid*".



in Nijmegen compared to this research is that the former data is experimental, contrary to the data of the orchestras.

Edin and Lagerström (2006) did research to an option for applicants in the Internet-based CV database of the Swedish Public Employment Office to conceal part of their personal information from employers / recruiters. Applicants were able to conceal their age, gender and ethnicity from the employers / recruiters. The database included 8,043 applicants, from which 922 applicants chose to conceal their personal characteristics. In this article only the first phase of the job assignment process is analyzed, the possible invitation of applicants for a job interview. They have found evidence of significant gender and age discrimination in the Swedish labor market, but not of significant discrimination on the basis of ethnicity. According to the authors this is at least partly the result of measurement errors. The concealing of personal information significantly increases the probability of women to be contacted for an interview; for older applicants and immigrants the effect is positive at the same order but not statistically significant. Contrary to the article of Goldin and Rouse (2000) this article is aimed at the labor market, like the experiments in Nijmegen. Other similarities with the experiments in Nijmegen are that the results are based on public sector data and that the immigrants are defined by a foreign sounding name. However, an important difference is that the applicants themselves choose to conceal their gender and name, which means that they of course know that the information is hidden for employers / recruiters. This may result in selection effects, the applicants with a foreign sounding name are for example on average more often in the group with the personal characteristics concealed from the employers, because they more often expect to be discriminated. A second difference is that in this experiment not only the applicants' ethnicity is concealed, but also their age and gender. Finally, the experiment is based on data of an online job search database, which may contain a sample which is on average not representative for the total labor market.

The most convincing article concerning the effectiveness of anonymous job application procedures in the labor market is written by Åslund and Skans (2007), they provide evidence of the effectiveness of anonymous job application procedures in Sweden. An anonymous job application experiment in three city districts of Gothenburg is investigated, the sample included 3,529 applications, 1,408 application procedures were 'anonymous'. In the experiment under the anonymous job application procedure the applicants themselves provide an application letter and CV without information about their gender and ethnicity, contrary to the experiment in Nijmegen in which applicants send a normal application letter and CV. The

advantage is that the procedure is more reliable, because the ethnicity of applicants is concealed better, but now applicants know they are part of an experiment which may result in applicant selection effects. As a consequence the proportion of ‘over-qualified’ applicants in the experiment group without anonymous job application is higher, because in this group on average more immigrants expect to be discriminated. However, the difference between the two experiment groups is not statistically significant. Like the experiments in Nijmegen this experiment covers both phases of the job assignment process, the inviting of the applicants for an interview and the hiring decision. Another similarity is that both experiments are conducted in the public sector. An important difference, in comparison with the experiment in Nijmegen, is that in this experiment the ethnicity of applicants is based on their own view, the applicants themselves define their region of origin.<sup>30</sup> Besides that the applicants are divided in native, western immigrant and non-western immigrant applicants. This is different from the experiment in Nijmegen, in which there are only two groups and the ‘sounding’ of the name is decisive. Åslund and Skans (2007) have found significant evidence of discrimination against non-western immigrant and female applicants for both interview invitations and the hiring of applicants. In comparison with native applicants non-western immigrants have a 8.9% lower probability to be invited for an interview and a 2.1% lower probability to be hired. For women the probability to be invited for an interview is 6% lower and the probability to be hired is 3.8% lower. The anonymous job application procedure increases both the probability of immigrants and women to be invited for an interview with approximately 8 percent, those effects are statistically significant. The probability of women to be hired for the job also significantly increases, with approximately 7%, but no such effect is found for immigrants. Being ‘overqualified’ has a non-significant negative effect on the probability to be invited for an interview and on the probability to be hired.

### **3. Theoretical models of discrimination**

In this section I discuss the different theoretical models of discrimination: models of taste-based and statistical discrimination. Those models theoretically explain the existence of discrimination in the labor market. Most models are about wage discrimination of minority group workers, those models only give an indication of the effect of discrimination on immigrants’ chances during the job assignment process. I also discuss the models of Coate and Loury (1993a, 1993b), which are about the job assignment process and assume equal

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<sup>30</sup> This is put into practice by looking at applicants’ ‘mother tongue’ and nationality in the CVs and letters of application, otherwise the applicants’ birthplace is used.

wages for all groups of workers. Those models directly indicate the sort of discrimination which may arise during the experiments in Nijmegen.

### **3.1 Models of taste-based discrimination**

Taste-based models of discrimination are all models in which discrimination arises due to the ‘taste’ or ‘distaste’ of employers, employees or customers for workers of a certain group. The literature on taste-based models of discrimination is especially based on Becker (1957) and Arrow (1973). I briefly discuss the basis model of taste-based discrimination by employers. I concentrate on employer discrimination, because this form of taste-based discrimination is the most relevant in relation to the job assignment process.

As indicated employers have a personal ‘taste’ or ‘distaste’ for a certain group of workers, this ‘(dis)taste’ may be caused by prejudices. The employers are willing to sacrifice part of their profits to prevent the hiring of workers of the concerning group. A perfectly competitive labor market, perfect information and a general equilibrium with full employment are assumed. The ‘distaste’ of employers for one of the groups of workers becomes evident in a negative marginal utility of employers of hiring workers of the discriminated group. Because employers maximize their utility by equalizing the marginal productivity of each worker to the total ‘costs’<sup>31</sup> of hiring the concerning worker, the wage paid to the discriminated workers is lower. Discrimination results in a redistribution of incomes in favor of the non-discriminated group of workers and the employers. If the firms (employers) differ in their ‘taste’ or ‘distaste’ for certain group of workers their discriminatory behavior is at the cost of the efficiency; it acts like a tax on the employer. The labor market allocation is in that case not efficient because the marginal productivity of labor differs between the firms. Besides that a segregated workforce arises, because the discriminated workers are employed at the least discriminatory firms. The lower wages for discriminated workers are vulnerable to market forces in the long term. The less discriminatory firms hire the underpaid workers, who are equally productive, which gives them a cost advantage. In the long term discriminatory firms will be driven out of the market, so taste-based models of discrimination predict no discrimination in the labor market in the long term. On the basis of the former reasoning taste based discrimination is not the main form of discrimination, because there is persistent discrimination in the labor market.<sup>32,33,34</sup>

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<sup>31</sup> Those costs include the wage of the worker and the marginal disutility of the employer. Becker (1957) defines the latter part of the costs of hiring the worker as the ‘discrimination coefficient’. For workers of the other group the total costs of hiring a worker are equal to the wage.

<sup>32</sup> See section 2 for empirical evidence.

Coate and Loury (1993a) have developed a theoretical model of taste-based discrimination which treats the job assignment process and in which the wages (after the hiring decision) are equal for all groups of workers. Workers are ‘qualified’ or ‘unqualified’, which depends on whether they have invested in their human capital, ‘qualified’ workers are more valuable for firms. Discriminatory employers experience some psychic cost of hiring a minority group worker, this cost is larger the higher the ratio of minority group workers in the pool of accepted workers. In the model those employers hire all ‘qualified’ majority group workers and do not hire all ‘unqualified’ minority group workers. ‘Qualified’ minority group workers are hired until the moment at which the firms’ monetary return of hiring a ‘qualified’ (minority) worker is equal to the disutility of hiring minority workers, which depends on the ratio of hired minority group workers in the pool of hired workers. This is at the cost of the efficiency because the workers’ incentives to invest depend on their expected benefits and costs. Due to the lower expected benefits minority group workers under invest, which results in a lower fraction of ‘qualified’ minority group workers.

This model shows that also during the job assignment process minority workers are disadvantaged if employers have a ‘distaste’ for minority group workers, due to the employers’ ‘distaste’ their probability to be hired is much lower.

### **3.2 Models of statistical discrimination**

Central in the models of statistical discrimination is the fact that employers have limited (imperfect) information about the productivity of workers. In those models discrimination arises because employers expect the directly observable membership in a group to be a useful signal of productivity. Examples of such a directly observable group membership are again gender, ethnicity or age. As mentioned I concentrate on ethnical discrimination in this research. Stereotypes are beliefs about some unobservable trait of an individual based upon his membership in an identifiable group (Chaudhuri and Sethi, 2008). Stereotypes are based on previous statistical performance or prevailing sociological beliefs (Phelps, 1972). Employers who expect workers of a certain minority group to be less productive have negative stereotypes about the concerning group. Those beliefs of employers about the groups

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<sup>33</sup> See for example Altonji and Blank (1999) or Lundberg and Startz (1998) for a more extensive explanation about the vulnerability of taste-based discrimination models to market forces.

<sup>34</sup> On the basis of the original taste-based discrimination model variations are developed which explain the existence of discrimination in taste-based discrimination models in the long term. One option is the introduction of search costs and imperfect information about the job openings, workers, customers and whether people are prejudiced or not. See for example Borjas and Bronars (1989), Black (1995) and Bowlus and Eckstein (2002), who incorporate this in a theoretical model of taste-based discrimination.

of workers are incorporated in the model by their expectation of a certain proportion of the workers to be ‘qualified’ in each group. Employers have no racial preferences in this case, they statistically discriminate with the aim to maximize their profits. Another important difference is that statistical discrimination is not vulnerable to market forces.<sup>35</sup>

The fact that employers imperfectly observe the productivity of individual workers in statistical models of discrimination directed at the labor market, is incorporated by employers who observe a noisy signal (imperfect information) of the workers’ individual productivity (simplified to their investment decision) from a pre-employment test. Some of the workers who take part in the pre-employment test are ‘qualified’, but others are not. Whether workers are ‘qualified’ or not depends on their own investment decision prior to the test, investing improves the probability of a better test outcome from the pre-employment test. By investing in their human capital workers acquire more education or improve their skills.<sup>36</sup>

There are two main strands to the statistical discrimination literature, which are both in line with the above discussed characteristics. The first is based on the pioneering model of Arrow (1973).<sup>37</sup> In those models the relation between the prior beliefs about the productivity of workers and their actual productivity is central. The other strand of models is founded on Phelps (1972), who assumes that employers observe a less precise signal of the productivity of the workers of the discriminated group.

### **3.2.1 The precision of the observation of the workers’ productivity**

I first briefly describe the latter group of models. The most important extensions of the model developed by Phelps (1972) are by Aigner and Cain (1973), Lundberg and Startz (1983) and Lundberg (1991). I describe the basic model, largely in line with Lundberg and Startz (1983).

In this model discrimination arises due to a less precise signal of the pre-employment test for the minority group workers, this is caused by a larger variance of the test score, which is the predictor of the workers’ capabilities.<sup>38,39</sup> Lundberg and Startz (1983) prove the presence of discrimination in the labor market in this model. Due to the fact that the hiring decisions of employers are based on the noisy pre-employment test signals and the beliefs of employers

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<sup>35</sup> See for more explanation for example Lundberg and Startz (1998).

<sup>36</sup> In this case not the formal education is meant, but more general abilities, see for example Arrow (1973) for a more extensive description.

<sup>37</sup> Examples of articles elaborating this strand of models of statistical discrimination are: Coate and Loury (1993b), Moro and Norman (2003, 2004) and Norman (2003).

<sup>38</sup> This is in fact the result of the model of Aigner and Cain (1977).

<sup>39</sup> According the Phelps (1973) and Aigner and Cain (1977) statistical discrimination may also arise as a consequence of a lower average marginal productivity in a certain group.

about the group of the worker, all workers have lower incentives to invest. Workers under invest in their human capital, because the information of employers is imperfect. The incentives to invest of workers of the discriminated group decrease more severely, because employers' information about their productivity is of a poorer quality than the information about the other workers. As a consequence of the lower investments in human capital the (allocative) efficiency in the labor market decreases. Not the most efficient workers are hired and workers do not produce according to their abilities.<sup>40</sup>

Although this group of models of statistical discrimination is not directed at the job assignment process and different wage schedules are allowed for different groups of workers, the difference in the precision by which employers observe the workers' productivity probably also influences the job assignment process. It is logical to assume that the less precise signal of the productivity of minority group workers results in a lower probability to be hired during the job assignment process if the wages have to be equal for both groups of workers.

### **3.2.2 The employers' prior beliefs**

The other group of models of statistical discrimination is based on Arrow (1973). In those models discrimination arises due to the employers' negative prior beliefs about the minority group workers. Because the employers expect the proportion of 'qualified' workers lower in the minority group, the discriminated workers' expected benefits of investing in their human capital are lower. As a consequence the beliefs of the employers are confirmed, the fraction of invested workers is lower in the discriminated group.

Coate and Loury (1993b) extended the model of Arrow (1973) to the job assignment process. In this model the employers assign workers to a 'skilled job' or an 'unskilled job' on the basis of the pre-employment test score and their prior beliefs about the group of the worker. The workers prefer the former job. Again there are two groups of workers, which are perfectly observable for the employers.<sup>41</sup> Employers gain if they assign a 'qualified' worker to the 'skilled job' and get a loss if they assign an 'unqualified' worker to the 'skilled job'. Employers assign workers to the 'skilled job' if their noisy signal of productivity meets a certain 'threshold standard', which depends on the prior beliefs of the employers about the

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<sup>40</sup> Lundberg and Startz (1983) incorporate affirmative action in the model to eliminate the discriminatory behavior of employers. Lundberg (1991) extended this model because she noticed opportunities for employers to evade the described affirmative action policy.

<sup>41</sup> I discuss the situation in which the investment costs are equal for both groups because the aim of this section is to analyze the effect of discrimination. Higher investment costs for immigrants would indicate a disadvantaged position, for example due to unequal educational opportunities.

group of the applicant. The applicants invest in their human capital if the expected benefit of investing, given the ‘threshold standard’ for their group, is larger than the investment cost. Finally, an equilibrium arises in which the employers choose optimal standards given their prior beliefs and the proportion of investing workers in each group is in line with the standard for this group. In case of negative stereotypes a self-confirming discriminatory equilibrium arises, because the expected return of investing decreases for minority workers due to the higher ‘threshold standard’, the employers induce the workers to invest in line with their standards. The decreased incentives to invest of minority workers result in an inefficient allocation of workers. This model shows that minority group workers are disadvantaged due to statistical discrimination during the job assignment process, if negative stereotypes exist. Their probability to be hired is lower as a consequence of the lower prior expectations of employers about their group productivity.<sup>42</sup>

#### **4. General background anonymous job application**

In this section the general background of anonymous job application in the Netherlands is discussed. Besides that I describe the research design of the anonymous job application experiments in Nijmegen.

##### **4.1 Anonymous job application in the Netherlands: a short overview**

I start with a short introduction about the Dutch institutional background regarding discrimination and preference policies. According to Article 1 of the Dutch Constitution all people being in the Netherlands have to be treated equally. Discrimination on the basis of religion, philosophy of life, political background, race, sex or on any ground is prohibited. Giving a preferential treatment (affirmative action) to minority groups and women is limited in the Netherlands, to prevent the hiring of less qualified employees (Schippers, 2003). In the Netherlands, a preferential policy implies that employers are allowed to deviate from the general principle of equal treatment of equal persons (Ministerie van Sociale Zaken en Werkgelegenheid, 2006).<sup>43</sup> In this case employers are allowed preferring to hire female, immigrant or disabled workers, but only if these applicants are at least equally qualified as the competing applicants are.<sup>44</sup> Preferential treatment is allowed but not obliged by law in the Netherlands. Those policies are totally different from for example the affirmative action

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<sup>42</sup> Parts of the text of section 3 heavily rely on Kranendonk (2009).

<sup>43</sup> This is an exception to the AWGB, the general law on equal treatment, (in Dutch “Algemene Wet Gelijke Behandeling”).

<sup>44</sup> According to Schippers (2003) those weak preferential policies are applied in the Netherlands, but much less often for immigrants than for females.

policies in the US, where also less qualified applicants from minority groups are hired and slots on universities are reserved for (sometimes less able) minority group students (Ogletree, 1996). So discrimination is forbidden in the Dutch labor market, but preferential policies for minority group workers are weak. It is important to notice that also preferential policies are no longer possible after the introduction of anonymous job application procedures.

The past years there has been asked several times for anonymous job application experiments in the Netherlands. In 2005 the CBG ('Commissie Gelijke Behandeling')<sup>45</sup> suggested anonymous job application to prevent discrimination during the job assignment process. The reason for this advice was a case in which an applicant with a foreign family name was rejected outright after sending his letter of application, while another applicant with a Dutch family name who sent an almost identical letter of application was invited for an interview (Bureau Discriminatiezaken, 2005). According to the SER<sup>46</sup>-chairman Alexander Rinnooy Kan the introduction of anonymous job application eliminates negative stereotypes. In his view more experiments with anonymous job application are needed, because: "We do not live in a perfect world, and all opportunities to ban discrimination have to be seized".<sup>47</sup> In 2007, Hans de Boer, chairman of the 'Taskforce Jeugdwerkloosheid'<sup>48</sup> called the employers on to bring into force anonymous job application by themselves, because the parliament exercised restraint.<sup>49</sup> Finally, the Dutch minister of the Interior and Kingdom Relations, Guusje Ter Horst, is a strong supporter of anonymous job application. She is the former mayor of Nijmegen and the initiator of the experiments in Nijmegen. In case of positive results of the various experiments with anonymous job application minister Ter Horst aims to introduce the policy measure nationwide in the public sector.<sup>50</sup>

Under the authority of Manpower and the 'Taskforce Jeugdwerkloosheid' TNS NIPO<sup>51</sup> did research to the opinion and knowledge of the Dutch employers and labor force (workers) about anonymous job application. The results are published in Manpower (2007). According to this research anonymous job application is relatively unknown to the workers, 66% has never heard of the concept. Employers are better informed, 53% of them knows the concept,

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<sup>45</sup> Commission of equal treatment, a Dutch institute.

<sup>46</sup> The Social Economic Counseling body of the Dutch government, in Dutch: Sociaal-Economische Raad.

<sup>47</sup> Source: NRC, October 17, 2006.

<sup>48</sup> Taskforce Youth Unemployment.

<sup>49</sup> Source: Financieel Dagblad, January 17, 2007.

<sup>50</sup> Source: Volkskrant, June 23, 2007.

<sup>51</sup> TNS NIPO is a Dutch opinion research bureau.



but most employers do not exactly know what it implies. Employers who select applicants for an interview, after receiving the letter of application, base their selection decision particularly on experience (80%), education (64%) and whether the applicant satisfies the job criteria (56%). The style of the letter of application (37%) and age of the applicant (31%) play a smaller role. The ethnicity of the applicant seems to be not very important, only 12% of the employers mentions it as a selection criterion. In spite of that 17% of the immigrant workers considers not revealing their origin in the letter of application. Probably employers often gave the social desirable answer to the researchers of Manpower (2007), that the applicants' ethnicity is not a selection criterion for them in the job assignment process. Besides that the employers' attitudes are not automatically consistent with their (unconscious) behavior. Those effects may bias the importance of the selection criterion 'ethnicity' in the survey downwards.

In the Manpower (2007) survey there was a question regarding the opinion about anonymous job application. 54% of the workers has a positive opinion about anonymous job application. From the employers 29% is positive, but 41% is negative. This may be the result of higher costs for employers of an anonymous job application procedure or the result of their loss of information about applicants. I come back to this in section 6.2 and section 7.3. However, employers also deny the existence of discrimination in the labor market (Manpower, 2007), which would imply that anonymous job application would be redundant. Anonymous job application at least limits the possibilities to discriminate, which probably reduces its popularity with the employers.

#### **4.2 Other Dutch anonymous job application experiments**

The positive opinion of a lot of surveyed people about anonymous job application resulted in an experiment to test the policy measure by Manpower itself (Stoker, 2007). At that moment the public debate about anonymous job application procedures started already a year ago, so the survey results were not the only reason to start the experiment. From June until November 2007 761 job applications are assessed online by 'blind' and 'non blind' employers. From the 761 applicants 96 persons had a non-western cultural background, 30 a non-Dutch but western cultural background and 628 a Dutch one. In this experiment, contrary to the experiment in Nijmegen, the CBS definition of an immigrant worker is applied.<sup>52</sup> According

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<sup>52</sup> According to the CBS allochthonous people or immigrants ("allochtonen" in Dutch) are people who are born abroad or have at least one parent who is born abroad (CBS, 2008). The CBS definition distinguishes between western and non-western immigrants.

to Manpower<sup>53</sup> all three groups of workers are assessed similarly, they have found no evidence of discrimination. However, non-western immigrants are more often rejected for several reasons (47% compared to 26% for the other two groups), for example for both having not enough experience and having not the right characteristics for the function.

Another Dutch experiment with anonymous job application is executed by the city of Amsterdam in the districts ‘Westerpark’ and ‘Noord’. All job application procedures for the public sector of the district ‘Westerpark’ had to be ‘anonymous’. The length of the experiment was a half year. In this period 16 job openings are evaluated, for those job openings 507 people applied, from which 43 are invited for an interview. The control group was the district ‘Noord’, with 6 job openings and 67 applicants, from which 13 applicants are invited for an interview. In this experiment again the CBS definition of immigrant workers is applied. According to the conclusion of the experiment the policy measure anonymous job application is ineffective. This conclusion is based on the fact that the percentage of immigrants in the total number of employees in the public sector of the district ‘Westerpark’ only increased from 12.2% to 12.4%, while the (administrative) costs of the experiment were high (Stadsdeel Westerpark, 2008). In my opinion this conclusion is founded on biased indicators. To evaluate the effectiveness of anonymous job application the percentage of immigrant employees is used, which biases the results because a lot of other factors influence this percentage too. The conclusions should be founded on the new hired applicants and should be compared with the situation without the policy measure. Besides that the treatment and control group were totally different from each other, which decreases the reliability of comparisons. Another fact which may bias the results is the application of the CBS definition of immigrants, I explain this later.

### **4.3 The anonymous job application experiments in Nijmegen**

The policy experiments which are central in this research took place in Nijmegen, the Netherlands’ ninth largest city. The municipally Nijmegen had 161,675 inhabitants at the start of 2009.<sup>54</sup> The population of the total metropolitan area is about 277,000 inhabitants. The ethnic variation in Nijmegen is approximately representative for the Dutch average. In the city-district Nijmegen<sup>55</sup> the percentage immigrants was 18.9 in 2008, compared to the Dutch

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<sup>53</sup> Source: press release Manpower, January 14, 2008, “*Uitslag Manpower’s praktijkproef: Anoniem solliciteren niet van invloed op selectie CV*”.

<sup>54</sup> Source CBS, Dutch Statistical Bureau, updated March 27, 2009, online data, downloaded April 22, 2009. [www.cbs.nl](http://www.cbs.nl)

<sup>55</sup> I have chosen for the percentage of the city-district and not for the municipality itself, because it is reasonable that not only people living in the municipality Nijmegen apply for the jobs, but also people living in the direct neighborhood.

average of 19.6%.<sup>56</sup> These percentages are according to the CBS definition. In relation to this research the percentages of non-western immigrants are more important when the definition of the CBS is applied: in the city-district Nijmegen 8.3% of the people are non-western immigrants, the nationwide average is 10.3%.

In July 2006<sup>57</sup> the bench of Mayor and Aldermen decided to experiment with anonymous job application for a year. The purpose of the experiment was to examine whether the chances of minority group applicants to be invited for a job interview increase due to anonymous job application. As a consequence of a restricting motion adopted in August 2006<sup>58</sup> by the city council the length of the experiment was reduced to half a year. During this period all application procedures for the municipal administration of Nijmegen had to be ‘anonymous’. The experiment started at August 1, 2006 and ended at February 1, 2007. The evaluation of this experiment resulted in a new experiment with anonymous job application, to determine the effects with more certainty (Gemeente Nijmegen, 2008). The second experiment came to run from May 1, 2007 to January 1, 2008.

The municipal administration of Nijmegen contains seven local government departments. For the experiment the departments are divided into two groups, this division is not chosen randomly. The aim was to form two groups with a roughly equal number of employees and comparable fractions of immigrant employees (Gemeente Nijmegen, 2008). The first group contains the departments: “Stadsbedrijven”, “Grondgebied” and “Wijk en Stad” (1055 employees, 6% immigrant workers) and the second: “Inwoners”, “Concernstaf”, “Bestuursstaf” and “Brandweer” (909 employees, 9% immigrant workers).<sup>59</sup> During experiment 1 the first group of departments was the treatment group and the second group of departments the control group, in experiment 2 the groups were turned around. From now on I mention those groups ‘treatment group 1 or 2’ and ‘control group 1 or 2’.<sup>60</sup>

The experiments have a quasi-experimental research design, like in an experiment the treatment and control groups are compared, but in this case the subjects of research, the applicants and the departments (which include certain employers / recruiters and the job

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<sup>56</sup> Source CBS, Dutch Statistical Bureau, updated March 27, 2009, online data, downloaded April 25, 2009. [www.cbs.nl](http://www.cbs.nl)

<sup>57</sup> July 18, 2006. Source: “Collegevoorstel anonimiseren van sollicitatiebrieven”, published on: [www.nijmegen.nl](http://www.nijmegen.nl)

<sup>58</sup> August 23, 2006. Source: “Besluitenlijst gemeenteraadvergadering Nijmegen 23 augustus 2006” published on: [www.nijmegen.nl](http://www.nijmegen.nl)

<sup>59</sup> On January 1, 2007.

<sup>60</sup> The design of the experiments is described by Gemeente Nijmegen (2008).

openings) are not randomly assigned to the treatment and control groups. Because both the employers and applicants are not randomly assigned to the treatment or control groups selection effects of both employers and applicants may be a problem. I come back to this in section 5.4. Besides that the treatment and control groups in the experiment are not perfectly equal to each other, in both groups there are different job openings with sometimes different required education levels. The differences between the job openings and applicants in the treatment and control groups are discussed in section 5.2 and section 5.3.

A large advantage of the dataset is that the treatment and control groups are turned around in the second experiment, due to this property of the dataset it is possible to compare the effects of anonymous job application policy measure in a certain group of departments with the other group departments without the policy measure at the same moment (control group) and with the same group departments (control/treatment group in the other experiment) during the other experiment. In the former comparison the time period is the constant factor, in the latter the group of departments.

## **5. Data description**

### **5.1 The implementation of the anonymous job application experiment**

In Nijmegen, anonymous job application had to increase the chances of immigrants to be invited for a job interview. To put this into practice employers have to be prevented observing whether an applicant is an immigrant or not, during the job assignment process, in advance of the job interview. The implementation of anonymous job application, which is very important for the effectiveness of the policy measure, is the subject of this section.

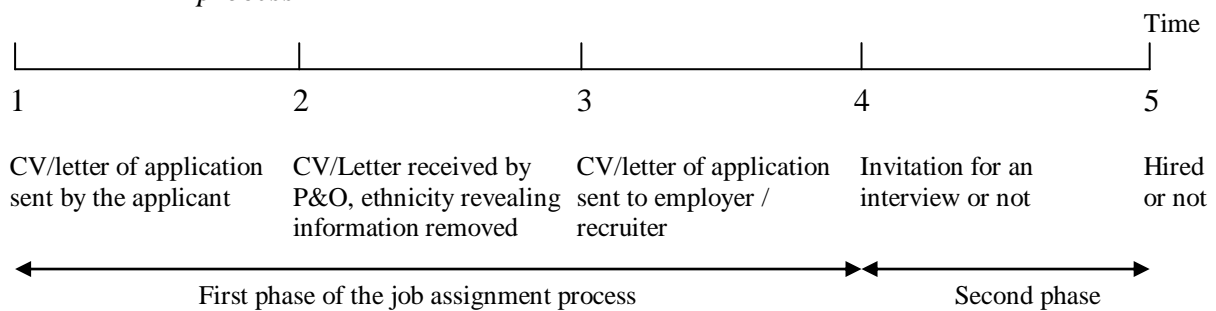
The dataset covers the whole job assignment process. The first step in this process is the sending of the letter of application, the applicants send their letter of application and CV to the city of Nijmegen. All letters of application and CVs first go to the department P&O<sup>61</sup> of Nijmegen. At this the department the information which directly reveals the ethnicity of the applicants, their name, place of birth, nationality, country of origin and e-mail address, is removed. Then the letters of application are sent to the employers / recruiters of the various departments. The employers / recruiters assess the adapted letters of application and select part of the applicants for an interview, without having information about the ethnicity of the applicants. Of course the ethnicity of the applicants is revealed during the interviews and is known afterwards, anonymous job application only directly influences the first part of the job application procedure. Finally, the employers / recruiters decide which applicants are hired,

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<sup>61</sup> Personnel and Organisation.

they take this decision after the job interviews so they know the applicants' ethnicity.<sup>62</sup> *Figure 2* shows this sequence of actions during the application procedure. The first four actions represent the first phase of the job assignment process, this phase ends with the invitation or rejection of the applicant for an interview. After that the second phase of the job assignment process starts, which is mainly about the employers' / recruiters' decision which applicants are hired after the interviews. Only the applicants who are invited for an interview take part in this phase of the job assignment process.

*Figure 2: Sequence of actions anonymous job application procedure / phases job assignment process*



On behalf of the experiment external job openings, letters of application and the invited applicants are analyzed between August 1, 2006 and February 1, 2007 and between May 1, 2007 and January 1, 2008. From both the job openings and the applicants several characteristics are registered. With respect to the applicants it concerns information about their level of education, gender, ethnicity and age. From the job openings the required education level and the job specific description are registered. According to the Manpower (2007) survey results those characteristics of the applicants should explain a large part of the decisions of the employers / recruiters during the job assignment process. In the view of Manpower (2007) only two important variables are missing in the dataset, the experience of applicants and their style of writing the letter of application. As a consequence the effects of those two variables should be in the error part of the analysis.<sup>63</sup> However, those not included variables may also influence other variables in the empirical analysis if the applicants' experience or their writing style is related to an overrepresentation of a group of applicants with respect to a certain characteristic, like ethnicity or being a female. For example if women have on average a much better (in the view of employers) writing style of letters of application than men, a positive effect of being a women may be partly caused by the writing

<sup>62</sup> Gemeente Nijmegen (2008) describes the anonymous job application procedure.

<sup>63</sup> In the error terms of equation (1) or equation (2), see section 6.1.

style of women. In that case the writing style is an underlying variable. With respect to the ethnicity of the applicants, the experience of the applicants may play a hidden role if immigrants are on average less experienced. In that case part of the ‘discrimination’ is explained by the underlying or third variable experience.<sup>64</sup> This may be a problem for the internal validity of the research. I discuss this more extensively in the section which treats the validity of the research (section 5.4).

The key variable of this analysis is the ethnicity of the applicants. The applicants are divided into two groups, the native applicants and the immigrant applicants. In the Netherlands there are various definitions of immigrants, ‘allochtonen’ in Dutch.<sup>65</sup> These definitions are not of use in this experiment. They are all based on the country of origin from the applicant or his parents, information which is often not included in the CV or letter of application.<sup>66</sup> For this reason in the experiment the family name of the applicant determines whether someone is an immigrant applicant or a native applicant. Applicants with a non-western sounding name are defined as immigrant workers and applicants with a Dutch or other western sounding name are defined as native workers (Gemeente Nijmegen, 2008). In line with this definition I also use the term ‘immigrant’ for all people with a non-western sounding name, this includes for example people with only grandfathers who are born abroad, but who are grown up in the Netherlands themselves. I apply this definition because those people also suffer from negative stereotypes, despite the fact that the definition deviates from the usual CBS definition of an immigrant worker.<sup>67</sup>

## **5.2 Description of the job openings**

During the first experiment 37 selection procedures are completed and during the second experiment 48. Part of the job openings pertained to several positions. In experiment 1 the total number of positions was 56 (20 anonymous, 36 not), in experiment 2 the total number

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<sup>64</sup> See for example Babbie (2007) for more explanation about the influence of a third or underlying variable on a causal relationship.

<sup>65</sup> For example the definition of the CBS. See footnote 52. Other examples are the VNG (association of Dutch communities) definition and the ‘Wet SAMEN en zelfidentificatie’ definition.

<sup>66</sup> This is especially aimed at the country of origin from the parents of the applicant, usually the country of origin from the applicant himself is in his CV.

<sup>67</sup> In line with the CBS definition such a person is not an immigrant, neither he himself nor his parents are born abroad. The other way around are people with for example a German mother excluded, while they are immigrants according to the CBS definition. This is why experiments in which the CBS definition is applied are less reliable.

was 68 (36 anonymous, 32 not).<sup>68</sup> As a consequence of the longer duration of the second experiment both the number of job openings and the number of positions was higher in the second than in the first experiment. The duration of the second experiment was extended to get the same number of applicants in the second treatment group as in the first one (Gemeente Nijmegen, 2008). This resulted in a larger number of applicants in experiment 2. *Table 1a* and *1b* indicate the number of job openings and the number of applicants for those job openings in both experiments, classified into the required education levels for the concerning functions.

In the first experiment the numbers of job openings on the various education levels in the treatment and the control group are very similar, the only difference is the higher number of WO<sup>69</sup> level job openings in the control group. In the second experiment the differences between the treatment and the control group are larger. In the treatment group the HBO<sup>70</sup> level is overrepresented in comparison with the control group, while the other two levels, WO and MBO<sup>71</sup>, are underrepresented. On average the required education level is higher in the second experiment than in the first, in the first experiment 43% of the job openings is on the HBO/WO levels, while this percentage is 69 in the second experiment.

As already indicated the experiment groups of the first experiment are turned around in experiment 2. Due to this property of the dataset it is possible to compare the outcome of the same group of departments under different treatments, but in a different period. Therefore I also discuss the similarity between treatment group 1 (2) and control group 2 (1). Treatment group 1 and control group 2 are very similar, except for a large overrepresentation of WO level job openings in control group 2. In treatment group 2 the number of HBO level job openings is overrepresented in comparison with control group 1, while the MBO level job openings are underrepresented.

The differences between the numbers of applicants for the jobs are large, but those differences may be also explained by individual characteristics of the job, like the kind of work, the location or the wage, not only by the number of job openings. In the empirical analysis I add a control variable to check for this. When comparing the same groups of departments the numbers of applicants are more similar.

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<sup>68</sup> The difference between the proportion of job openings over positions for the two experiments is not statistically significant (Chi-square test: p-value = 0.590). A significant difference would have influenced the number of applicants invited for an interview, which I discuss more extensively in section 6.2 and 7.3.

<sup>69</sup> University, in Dutch: “Wetenschappelijk Onderwijs”.

<sup>70</sup> Higher Vocational Education, in Dutch: “Hoger Beroepsonderwijs”.

<sup>71</sup> Intermediate Vocational Education, in Dutch: “Middelbaar Beroepsonderwijs”.

*Table 1a: Description of the job openings in the data of experiment 1*

Education level job opening	# job openings			# applicants		
	Treatment group 1	Control group 1	Total	Treatment group 1	Control group 1	Total
MBO	10	11	21	479	356	835
HBO	5	5	10	155	80	235
WO	2	4	6	29	101	130
Total	17	20	37	663	537	1200

*Table 1b: Description of the job openings in the data of experiment 2*

Education level job opening	# job openings			# applicants		
	Treatment group 2	Control group 2	Total	Treatment group 2	Control group 2	Total
MBO	7	10	17	237	421	658
HBO	13	6	19	319	163	482
WO	4	8	12	81	172	253
Total	24	24	48	637	756	1393

*Table 2* shows the number of applicants per job opening, the number of applicants invited for an interview per job opening and the fraction of invited applicants. The results for the total groups are ambiguous. During the first experiment the fraction of applicants offered an interview was significantly (1%) lower in the treatment group than in the control group, 9.5% compared to 14.3%. In the second experiment the outcome is reversed and again the difference is statistically significant (5%), the fraction invited applicants in the treatment group is 22% and it is 17.5% in the control group. The comparison between treatment group 1 and control group 2 results in the higher percentage for the control group, in case of treatment group 2 and control group 1 it results in the opposite result. Both differences in proportions are statistically significant at a significance level of 1%.

Taking a closer look at the data shows that the number of applicants per job opening in the groups strongly influences the results, for the groups with the higher (lower) number of applicants per job opening the fraction of invited applicants is smaller (larger). Looking at the results for the various function levels (based on the required education level) shows the same. Striking is that the fractions of invited applicants are higher in the second experiment, also in relation with the number of applicants per job opening. Especially for the HBO and WO function level job openings more applicants are invited, while the number of applicants per job opening is not clearly lower. This may be caused by the higher representation of jobs



which require higher education levels, the influence of the lack of information may be more important for the recruitment of employees for high level functions than for the lower ones.<sup>72</sup>

*Table 2: Number of applicants and interviewed applicants per job opening<sup>73</sup>*

Education level job opening		Experiment 1		Experiment 2	
		Treatment group 1	Control group 1	Treatment group 2	Control group 2
MBO	# applicants	47.9	32.4	33.9	42.1
	# invited interview	3.9	4.0	6.4	6.2
	Fraction invited	0.081**	0.124 <sup>++</sup>	0.190	0.147 <sup>++</sup>
HBO	# applicants	31.0	16.0	24.5	27.2
	# invited interview	3.0	3.8	5.0	6.5
	Fraction invited	0.097***	0.238	0.204	0.239 <sup>+++</sup>
WO	# applicants	14.5	25.3	20.3	21.5
	# invited interview	4.5	3.5	7.5	3.9
	Fraction invited	0.310**	0.139 <sup>+++</sup>	0.370***	0.180
Total	# applicants	39.0	26.9	26.5	31.5
	# invited interview	3.7	3.9	5.8	5.5
	Fraction invited	0.095***	0.143 <sup>+++</sup>	0.220**	0.175 <sup>+++</sup>

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exacts test in case of small numbers of observations.

\* Indicates a statistically significant difference at a 10% significance level between the proportions of treatment group 1 (2) and control group 1 (2). \*\* Indicates a statistically significant difference at a 5% significance level. \*\*\* Indicates a statistically significant difference at a 1% significance level.

+ Indicates a significant difference at a 10% significance level between the proportions of control group 1 (2) and treatment group 2 (1). ++ Indicates a statistically significant difference at a 5% significance level. +++ Indicates a statistically significant difference at a 1% significance level.

### 5.3 Description of the applicants

#### 5.3.1 Description of all applicants

*Table 3* describes the individual characteristics of the applicants. The first two rows indicate the fraction of applicants invited for an interview or hired for the job. These are the outcomes which are analyzed in the next sections. The differences between the proportions of invited applicants are already discussed. The proportions of hired applicants are significantly (1%) different from each other in the first experiment, unlike the percentages in the second experiment and between the same groups of departments. The number of competitors again has a large influence on the chances of the applicants.

<sup>72</sup> This is discussed more extensively in section 6.2 and 7.3.

<sup>73</sup> The lay-out / design of this table is based on Åslund and Skans (2007).

The other rows show the characteristics of the applicants. The fraction of immigrant workers is significantly (10%) lower in the treatment group of the first experiment, while it is significantly (10%) higher in the treatment group of the second experiment. Between the same group of departments there are no significant differences. The fraction of female workers is around 0.6 in experiment 1 and treatment group 2, but in control group 2 this fraction is lower. This difference is statistically significant (1%) with respect to both treatment groups. For the first experiment the exact age of all individual applicants is available, but for the second it is not. The average applicant is 38.5 years old in the first experiment, the difference between the treatment and control group is statistically significant at a 10% significance level. The classification of the applicants in age groups shows that the four experiment groups are very similar on this characteristic. The only exceptions are caused by the two highest age groups in control group 1, both treatment groups are significantly (1%) different from those proportions. The applicants' highest level of completed education is also part of the analysis. Education is specified to three levels: high, middle and low. In case of a high education level WO or HBO is completed by the applicant. The education level 'middle' represents a completed MBO or VWO.<sup>74</sup> The low level implies that the applicant finished an education lower than MBO, for example VMBO<sup>75</sup>, MAVO<sup>76</sup> or only primary school. In experiment 1 the fraction of high educated applicants is significantly (1%) higher in the control group than in the treatment group. This difference is explainable by the higher number of job openings for which WO education is required. The fractions of middle and low educated applicants are significantly (1%) higher in the treatment group. In the second experiment the high and middle educated applicants are significantly (5%) overrepresented in the treatment group and the low educated applicants are significantly (1%) underrepresented in this group. This is in accordance with the job openings. Comparing the same groups of departments shows a significant (1%) difference on the low education level between treatment group 2 and control group 1. Treatment group 1 and control group 2 show significant differences on the other two levels (1%) and the percentage observations from which the education level is unknown (5%).

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<sup>74</sup> Pre-university education in the Netherlands, in Dutch: "Voorbereidend Wetenschappelijk Onderwijs".

<sup>75</sup> Lower secondary professional education, in Dutch: "Voorbereidend Middelbaar Beroepsonderwijs".

<sup>76</sup> School for lower general secondary education, in Dutch: "Middelbaar Algemeen Voortgezet Onderwijs".

*Table 3: Further description applicants*

	Experiment 1		Experiment 2	
	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Invited for interview	0.095***	0.143 <sup>+++</sup>	0.220**	0.175 <sup>+++</sup>
Hired	0.030***	0.067	0.049	0.038
Immigrant worker	0.154*	0.194	0.193*	0.155
Female	0.606	0.570	0.598***	0.501 <sup>+++</sup>
Age	39.05*	37.90	-	-
<30	0.223	0.235	0.218	0.220
30-45	0.400***	0.486 <sup>+++</sup>	0.418	0.447
45-65	0.350***	0.255 <sup>+++</sup>	0.325	0.312
Unknown	0.027	0.024	0.039*	0.021
Education level				
Low	0.122***	0.065 <sup>+++</sup>	0.022***	0.136
Middle	0.554***	0.389	0.430**	0.356 <sup>+++</sup>
High	0.309***	0.520	0.535**	0.476 <sup>+++</sup>
Unknown	0.015	0.026	0.013**	0.032 <sup>++</sup>
# observations	663	537	637	756

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exacts test in case of small numbers of observations. For the age in experiment 1 a two-sample t-significance test is applied.

\* Indicates a statistically significant difference at a 10% significance level between the proportions of treatment group 1 (2) and control group 1 (2). \*\* Indicates a statistically significant difference at a 5% significance level. \*\*\* Indicates a statistically significant difference at a 1% significance level.

+ Indicates a significant difference at a 10% significance level between the proportions of control group 1 (2) and treatment group 2 (1). ++ Indicates a statistically significant difference at a 5% significance level. +++ Indicates a statistically significant difference at a 1% significance level.

The completed education level is not a perfect predictor of the required education level of the job openings the workers apply for. As discussed experience also plays a role, by having more experience applicants are able to apply for a job on a higher education level. In the dataset of the anonymous job application experiment in Nijmegen there is no information included about the experience of the applicants.

### 5.3.2 Description of applicants invited for an interview

For the analysis of the second phase of the job assignment process a sample including only the applicants invited for an interview is used. In this section I discuss the characteristics of the applicants in this sample. *Table 4* shows those characteristics. The first row shows the percentage of workers hired from the concerning group, this is the subject of analysis of section 7.2. Those percentages are heavily related to the number of invited applicants, the percentages are higher (lower) in the smaller (larger) experiment groups. The only statistically significant (1%) difference is between treatment group 2 and control group 1.

*Table 4: Further description applicants invited for an interview*

	Experiment 1		Experiment 2	
	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Hired	0.317	0.468 <sup>+++</sup>	0.221	0.220
Immigrant worker	0.143	0.117	0.179	0.147
Female	0.603	0.571	0.564	0.492
Age	36.82	37.05	-	-
<30	0.206	0.221	0.193	0.174
30-45	0.619	0.532	0.529	0.606
45-65	0.175	0.234	0.221	0.182
unknown	0.000	0.013	0.057	0.038
Education level				
Low	0.063	0.040	0.022 <sup>***</sup>	0.107
Middle	0.571 <sup>**</sup>	0.373	0.396	0.344 <sup>+++</sup>
High	0.365 <sup>**</sup>	0.587	0.583	0.550 <sup>++</sup>
Unknown	0.001	0.000	0.000	0.000
# observations	77	63	139	131

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exacts test in case of small numbers of observations. For the age in experiment 1 a two-sample t-significance test is applied.

\* Indicates a statistically significant difference at a 10% significance level between the proportions of treatment group 1 (2) and control group 1 (2). \*\* Indicates a statistically significant difference at a 5% significance level. \*\*\* Indicates a statistically significant difference at a 1% significance level.

+ Indicates a significant difference at a 10% significance level between the proportions of control group 1 (2) and treatment group 2 (1). ++ Indicates a statistically significant difference at a 5% significance level. +++ Indicates a statistically significant difference at a 1% significance level.

The other rows show the invited applicants' other characteristics. With respect to the applicants' ethnicity, gender and age there are no statistically significant differences. The groups differ only statistically significantly concerning the highest completed education levels of the applicants. Treatment group 2 shows a striking low percentage of low educated applicants, which is statistically significantly (1%) lower than this percentage for control group 2. In treatment group 1 the percentage of middle educated applicants is very high, this difference is statistically significant compared to both control group 1 (5%) and 2 (1%). Contrary to that the percentage of high educated workers is low in treatment group 1, this difference is statistically significant (5%) compared to both control groups.

## 5.4 Validity

### 5.4.1 Internal validity

Internal validity refers to the fact that the causal relationship indicated in an experiment accurately reflects what has gone in the experiment itself (Babbie, 2007). In this section I discuss a few important factors which may threaten the internal validity of this research. I start

with discussing the assumption that employers / recruiters largely found their discriminatory behavior at the cost of immigrants on the applicants' name. The possible selection effects and differences between the experiment groups are the next subject of discussion. Then I continue with the influence of media attention on the employers' / recruiters' behavior in both experiments. After that I discuss time effects and finally I end with the differences between the native and immigrant applicants in both samples.

As discussed in section 5.1 whether an applicant is defined as an 'immigrant' depends on his name. The applicants with a non-western sounding name are defined as immigrants. As already discussed I apply this definition because I expect that some people who are not defined as immigrants by the CBS definition of immigrants suffer from negative stereotypes, while others who are defined as immigrants by the CBS definition probably in general do not suffer from negative stereotypes. Bertrand and Mullainathan (2004) applied a similar definition in their discrimination experiment, as discussed in section 2.1. Besides that this way of defining immigrants fits in with the theory of statistical discrimination; employers discriminate on the basis of a signal from which they expect to be an indicator of productivity, in this case the workers' ethnicity.<sup>77</sup> Because usually someone's name reveals his ethnicity employers often found their discriminatory decisions on the applicants' name in the letter of application. Finally, the findings of Carlsson and Rooth (2008), which are discussed in section 2.1, support the assumption that the name of the applicants is the most sensitive to discrimination by employers / recruiters, because Carlsson and Rooth (2008) conclude that 77% of the employers' discriminatory behavior is explained by a foreign sounding name.

Despite the differences between the experiment groups discussed in sections 5.2 and 5.3 and the possible selection effects due to the quasi-experimental research design I expect the results of the different experiment groups to be accurate to compare. First, because all investigated departments are in the same city-district and all departments of the local authority took part in the experiment. All applicants are on the same local labor market and apply for public sector jobs in the city-district. Second, the choice to be in the treatment or control group is not made by the employers / recruiters who have to deal with the anonymous job application procedure. This decision is made by the bench of Mayor and Aldermen, so it is impossible for employers / recruiters to select into the treatment or control group. There are no employer / recruiter selection effects. Third, there are also no applicant selection effects.

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<sup>77</sup> This is in line with for example Arrow (1973) and Coate and Loury (1993b), who constructed models of statistical discrimination in which employers discriminate on the basis of group membership because they expect group identity to convey information. See section 3.2 for more explanation.

At the start of the first experiment probably most applicants were not aware of the experiment. The experiment is announced in the media, but not on a very large scale and there is not given very much attention to it. Selection into one of both groups was impossible because the division of the groups was hidden. At the start of the second experiment there was more media attention and as a consequence more applicants knew they were part of the experiment. But the groups were hidden again, so selection into an anonymous job application procedure was impossible.

The media attention may also influence the behavior of employers / recruiters in the control groups, because in the second experiment probably more employers / recruiters know that they are part of the experiment, compared to the first experiment.<sup>78</sup> Probably employers / recruiters behave less discriminatory during the job assignment process if they know they are part of an experiment, which implies they are monitored. It depends on the information in the media whether the employers / recruiters know that they are part of an anonymous job application experiment. Less discriminatory behavior of employers / recruiters would also decrease the effects of the anonymous job application policy measure, because in that case there is no or less discrimination to eliminate. It is difficult to assess this effect, because there is no detailed information available about the media attention during both experiments. Therefore I assume that the media attention has no influence on the behavior of the employers in both the treatment and the control groups. This assumption is supported by Carlsson and Rooth (2009), who did research to the effect of media attention during an experiment in which they investigated discriminatory behavior of employers during the job assignment process. Their results show that employers did not change their hiring practices neither when being aware of the risk of being included in the discrimination experiment, nor by more media attention for the concerning experiment. On the basis of those arguments I do not expect that the difference in media attention decreases the reliability of comparisons between the experiment groups. By assuming equal circumstances it is impossible to overestimate

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<sup>78</sup> In the treatment groups all employers / recruiters know in both experiments that they are part of the experiment, because they receive the 'anonymous' CVs and letters of application. The employers who are in the control groups formally do not know whether they are part of the experiment, they are not informed about the experiment. The employers / recruiters in the second control group were in the treatment group during the first experiment. This means they know how the anonymous job application procedure works. I assume this does not increase the probability that they know to be part of the second experiment, because it still depends on the media attention whether they know to be part of the control group of the experiment. Otherwise they could not know when the second experiment started or whether a second experiment started.

discrimination and the effects of anonymous job application, because the discrimination is even stronger than the results show if the media attention indeed influenced the behavior of employers / recruiters in the second control group.<sup>79</sup> That would also increase the likelihood of evidence of a positive effect of the anonymous job application policy measure on the immigrants' chances.

I assume there are no time effects between the two experiments. This is important with respect to the comparisons between the experiments, which are needed to compare the same groups of departments. The experiments took place in a reasonably short time period, with only three months in between them. As a consequence it is reasonable to assume that the same employers / recruiters took the decisions during the job assignment processes.<sup>80</sup>

The next threats to the internal validity I discuss are differences between the native and immigrant applicants in the two samples. I start with the sample which includes all applicants. *Table A1* in the appendix shows, in addition to the descriptive statistics shown in *table 3*, the appearance of the individual characteristics inside the two ethnic groups, native and immigrant applicants. The first column indicates for example that 59.2% of the native applicants in treatment group 1 is female. The first two rows show the subjects of research in section 7, so I do not discuss them; I only discuss the differences in the applicants' characteristics between the native and immigrant applicant groups. The table shows that females are statistically significantly overrepresented in all four immigrant groups. With respect to the applicants' age the table shows that the average age of native workers is significantly higher in the groups of the first experiment. This is caused by an underrepresentation of the young group and an overrepresentation of the old group, both differences are statistically significant. Those effects arise in all experiment groups. The proportions of the middle age groups are very similar. The middle age groups represent the largest applicant group, so it is very important for the internal validity of the research that those proportions are similar. The differences between the education levels of the applicants are smaller. The proportions of middle educated immigrant applicants are significantly higher than the proportions of middle educated native applicants in all groups. Contrary to that the

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<sup>79</sup> This group represents the control group part of the second experiment and of the first group of departments.

<sup>80</sup> In case of a longer time period between the experiments probably a larger part of the employers / recruiters is replaced, this may bias the comparison between the two groups, in that case the internal validity decreases due to 'experimental mortality' (Babbie, 2007).

high educated applicants are overrepresented in the native applicant groups, this effect is statistically significant in three experiment groups.

The above discussed differences may indicate hidden effects, caused by underlying variables, in the results of the analysis. On the basis of this table it is possible to assess the existence of an underlying variable which influences the probability of immigrants to be invited for an interview. As discussed the most obvious underlying variable is the applicants' experience. The age of the applicants is to a certain extent a proxy for the applicants' experience. As a consequence the overrepresentation of young immigrants in the immigrant group may indicate that immigrants also have a lower chance to be invited for an interview because they are on average are less experienced. In that case a lower probability of immigrants to be invited for an interview is partly explained by their lack of experience and not by discriminatory behavior of employers / recruiters. The proportions in *table A1* show some support for this proposition, the proportion of young applicants is higher for immigrants, but the largest groups, the middle age groups, show very similar proportions. The results of the empirical analysis partly show whether experience plays a hidden role, if the underlying variable experience plays a large role the anonymous job application policy measure cannot be effective in reducing discrimination, because the experience of the applicants is not concealed from the employers / recruiters by the policy measure.

I continue with discussing the sample of the analysis of the second phase of the job assignment process, which only includes the applicants who are invited for a job interview. *Table A2* in the appendix shows, in addition to the descriptive statistics about the sample of invited applicants shown in *table 4*, the appearance of the individual characteristics of the native and immigrant applicants. The first column indicates for example that 63% of the invited native applicants in treatment group 1 is female. I do not discuss the proportions on the first row, because the percentages hired applicants from both groups are the subject of analysis in section 7.2. I briefly discuss the significant differences between the immigrant and native applicant groups in relation to the applicants' characteristics. With respect to the first characteristic, the gender of applicants, only one significant difference between native and immigrant applicants arises inside the experiment groups, immigrant females are significantly overrepresented in treatment group 2. The differences in age inside the groups of applicants are statistically significant in treatment group 1 and control group 2, in both cases young immigrants are overrepresented. The differences in education level are statistically significant between the invited native and immigrant applicants for the middle educated applicants in



treatment group 2 and for both the middle and high educated applicants in control group 2. I conclude that the second sample, which only includes the invited applicants, only shows a few statistically significant differences between immigrant and native applicants. As a consequence there are no problems with respect to the internal validity of the analysis of the second phase of the job assignment process due to the overrepresentation of immigrants in relation to a certain characteristic.

On the basis of the above discussed differences it is also possible to draw a conclusion about the effect of the differences between the native and immigrant applicants in the whole sample, which are discussed above. With respect to the threat of the underlying variable ‘experience’ in the first phase of the job assignment process, the proportions invited applicants (the applicants included in the second sample) show that there is still a difference between the proportions of young immigrant and native applicants. The differences are still significant in two of the four groups, which suggest that the effect of the possible underlying variable on the results in the first phase of the job assignment process is small.

#### **5.4.2 External validity**

The external validity of an experiment refers to whether the results are generalizable to the ‘real’ world (Babbie, 2007). With respect to the results found in the experiments in Nijmegen a few factors play an important role. The first is the country, the Netherlands, a western country with anti-discrimination laws and weak preferential policies, as discussed in section 4.1. The second factor is the sector, the experiments took place in the departments of the municipality of Nijmegen, which are part of the public sector. Important to mention is that in the Netherlands job application procedures in the public sector are equal to those in the private sector, contrary to for example the application procedure of teachers in the French public sector.<sup>81</sup> However, the audit tests of Bovenkerk, Gras and Ramsoedh (1995) show that firms in the private sector are substantially more likely to discriminate than firms in the public sector in the Netherlands.<sup>82</sup> As a consequence the results of the experiments in Nijmegen probably underestimate discrimination in the private sector of the labor market. Important with respect to the applicability to the private sector is that the ‘mechanism of discrimination’ is the same in both the public and the private sector, this concerns for example on which objective the employers found their decision to discriminate immigrants during the job

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<sup>81</sup> See for example Bressoux, Kramarz, and Prost (2008) for a description of the French teacher application procedure.

<sup>82</sup> They have found statistically significant differences between the public and the private sector with respect to the percentages of immigrants and native applicants who are invited for an interview.

assignment process or not. This objective is probably not similar in the two sectors, employers / recruiters in the private sector have profit-maximization as their main goal. This may stimulate employers to statistically discriminate to increase their profits, but may also restrain them from taste-based discriminatory behavior. In the public sector the employers / recruiters do not have profit maximization as their main goal, which may result in other intentions during the job assignment process, in comparison with the private sector. Part of this may also be influenced by (voluntary) diversity policies. In case of diversity policies the representation of immigrant workers has to be improved or immigrant workers have to be represented proportionally to their qualifications. Such policies, which are not obliged by law, play a much larger role in the public sector than in the private sector.

## **6. Empirical Analysis**

In this section I describe the way I assess empirically whether anonymous job application is able to eliminate discrimination in the labor market during the job assignment process. The impact of the ethnicity of the applicants on the probability to be invited for a job interview and on the probability to be hired is the first main factor of analysis. The second is the effect of the anonymous job application procedure on the probability to be invited for a job interview or to be hired for immigrant applicants. Besides that I describe how the efficiency effects of anonymous job application procedures are assessed and how the existence of ‘hidden discrimination’ in the labor market is investigated.

### **6.1 Discrimination and the effectiveness of anonymous job application**

The anonymous job application policy measure conceals the ethnicity of the applicants until the job interview, so in the treatment groups employers / recruiters are only able to discriminate after the interview, which becomes evident in the hiring decision. In the control groups employers / recruiters have two opportunities to discriminate, the first is when they invite applicants for an interview and the second is again after the interview: the hiring decision.

In the control groups I expect discrimination to take place especially in the first phase of the job assignment process, when applicants are invited for an interview or not. This is the most obvious moment to discriminate for employers / recruiters, because it is their first opportunity to discriminate.<sup>83</sup> Both models of the taste-based and statistical discrimination

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<sup>83</sup> Inviting applicants for a job interview while you know in advance that you will not hire them is a waste of money and time, so discriminatory employers / recruiters probably discriminate at their first opportunity.

predict discrimination to occur in the control groups during the first phase of the job assignment process in a discriminatory labor market, like discussed in section 3.

In the treatment groups there is only one opportunity left to discriminate for employers / recruiters: after the job interview. In line with the taste-based models of discrimination employers / recruiters discriminate immigrants in the treatment groups of the second phase of the job assignment process, because from that moment they are again able to discriminate. According to the literature about models of statistical discrimination, discriminatory behavior of employers / recruiters may also arise in the second phase of the application process. However, in models of statistical discrimination it is also possible that the elimination of discrimination in the first phase of the job application process strongly influences the whole job assignment process, including the final outcome. This is the case if discriminatory employers / recruiters are able to ‘update their information’ about the immigrant applicants during the interview and the interview eliminates the stereotypes of the employers which are based on the employers’ experience and prevailing sociological beliefs. This depends on the information on which the stereotypes are based and on how informative the interviews are. In this case the concerning employers / recruiters do not discriminate at all in the treatment groups. With respect to the first strand of models of statistical discrimination (which depend on the employers’ prior beliefs), it implies that the negative prior beliefs of the employers are eliminated between the first and the second phase of the job assignment process. In case of the second strand of models of statistical discrimination (which depend on a less precise signal of productivity of minority group workers), there is no longer a difference in the precision with which employers / recruiters observe the productivity of immigrants.

I start with analyzing whether there is discrimination of immigrant workers during the first phase of the job assignment process, the invitation of applicants for a job interview on the basis of the applicants’ letters and CVs. I assess this by testing hypothesis 1.

*Hypothesis 1:*

*H<sub>0</sub>: Immigrant and native applicants have equal chances to be invited for a job interview after sending a letter of application ( $H_0: \beta^{ethn} = 0$ ).*

*H<sub>a</sub>: Immigrant and native applicants do not have equal chances to be invited for a job interview after sending a letter of application ( $H_a: \beta^{ethn} \neq 0$ ).*

To test hypothesis 1 I estimate the impact of the ethnicity of the applicants on the probability to be invited for an interview in the following linear probability model:

$$y = \alpha + \beta^{ethn} * ethnicity + \beta^{sex} * sex + \beta^{age} * age + \beta^{job} * job + \beta^{educ} * education + \varepsilon \quad (1)$$

In this model  $y$  denotes whether an applicant is invited for a job interview, it equals one in case of an invitation for an interview and zero otherwise. The dependent variable indicates the probability to be invited for a job interview. ‘Ethnicity’ is a dummy variable, which is one in case of an immigrant applicant and zero otherwise.  $\beta^{ethn}$  is a vector of the influence of the ethnicity of applicants. A statistically significant influence of this variable can be interpreted as a measure of discrimination.

The other variables check for the influence of the gender, age and education of the applicant and the job specific effects. ‘Sex’ is also a dummy variable; it is equal to one in case of female applicants and zero for male applicants. To analyze the effect of the applicants’ age they are divided into three age groups, which are incorporated by the use of dummy variables. The first group includes all applicants under the age of 30, the second group includes the applicants between 30 and 45 and finally the last group consists of the applicants who are at least 45 years old. There is controlled for job specific effects by the  $\beta^{job}$  coefficient, again by dummy variables, for every job opening a dummy is incorporated. Those job specific effects include for example differences in the number of applicants per job opening and differences in the number of invited applicants per job opening, which are shown in *table 2*.  $\varepsilon$  is an error term, as discussed in section 5, this term should represent factors like the applicants’ experience and style of writing the letter of application, completed with the other noise in the estimation.

I estimate equation (1) for all four experiment groups. Hypothesis 1 is rejected if the influence of the ethnicity of applicants is statistically significant. If this is not the case there are equal chances for native and immigrant applicants in the first phase of the job assignment process, this is the desired outcome. In this way I assess the first opportunity for employers / recruiters to discriminate in the control groups. Evidence of discriminatory behavior of employers / recruiters may indicate taste-based discrimination or statistical discrimination, because both forms arise in the first phase of the job assignment process, if the employers / recruiters are discriminatory. In the treatment groups anonymous job application is introduced, so employers / recruiters should not have an opportunity to discriminate in this

phase of the job assignment process. Evidence of discrimination in those groups would indicate that the anonymous job application policy measure fails. If hypothesis 1 cannot be rejected for the treatment groups anonymous job application seems to work as intended. All applicants are included in those tests, because they all applied for the job openings and they all have a chance to be invited for an interview. Finally, to check the results for heterogeneous effects I test hypothesis 1 also for the different groups of job openings, specified to the different required education levels.

Now I have assessed the existence of discrimination in the labor market, with and without anonymous job application procedures, but the aim is to analyze the effectiveness of the anonymous job application policy measure. Therefore I test the following two hypotheses:

*Hypothesis 2:*

*H<sub>0</sub>: Ceteris paribus, the anonymous job application procedure does not change the probability of immigrants to be invited for a job interview after sending a letter of application ( $H_0: \beta^{effect} = 0$ ).*

*H<sub>a</sub>: Ceteris paribus, the anonymous job application procedure changes the probability of immigrant applicants to be invited for a job interview after sending a letter of application ( $H_a: \beta^{effect} \neq 0$ ).*

*Hypothesis 3:*

*H<sub>0</sub>: Ceteris paribus, the anonymous job application procedure results in a job assignment process in which immigrant and native applicants have equal chances to be invited for a job interview after sending a letter of application ( $H_0: \beta^{effect} + \beta^{ethn} = 0$ ).*

*H<sub>a</sub>: Ceteris paribus, the anonymous job application procedure does not result in a job assignment process in which immigrant and native applicants have equal chances to be invited for a job interview after sending a letter of application ( $H_a: \beta^{effect} + \beta^{ethn} \neq 0$ ).*

Because the dataset contains less information about the applicants than the information available for employers it is not possible to point out a causal relationship between the policy measure and the existence of discrimination in the labor market on the basis of estimating equation (1). Therefore I estimate a second empirical model, which is able to formally test whether anonymous job application has an (significant) impact on discrimination in the labor

market (hypothesis 2) and whether the final result in this phase of the job assignment process is discriminatory (hypothesis 3). I estimate the following linear probability model:<sup>84</sup>

$$y = \alpha + \beta^{ethn} * ethnicity + \beta^{AJA} * AJA + \beta^{effect} * (AJA * ethnicity) + \beta^{sex} * sex + \beta^{age} * age + \beta^{job} * job + \beta^{educ} * education + \varepsilon \quad (2)$$

In equation (2),  $\beta^{AJA}$  indicates the effect of the anonymous job application procedure, the dummy equals one for the application procedures in which the ethnicity revealing characteristics<sup>85</sup> of the applicants are concealed.  $\beta^{effect}$  is the main factor of interest in this model, this variable captures the change in probability to be invited for an interview of immigrants as a consequence of the anonymous job application policy measure. In case of a statistically significant effect of this variable there is evidence of a causal link between the effects of the ethnicity of the applicants during the job assignment process and the introduction of the anonymous job application procedure. A significant influence of the ethnicity of applicants on the probability to be invited for an interview again indicates discrimination. The sum of the former two coefficients has to be not significantly different from zero for a non-discriminatory first phase of the job assignment process in the anonymous job application groups. I test this (hypothesis 3) by applying Wald tests on the combined effect of the two coefficients. To check the results for heterogeneous effects hypothesis 2 and 3 are also tested for the different groups of job openings, specified to the required education levels.

The next subject of analysis is the second phase of the job assignment process, the hiring of the applicants. In this analysis only the applicants who are invited for a job interview are included, because all the other applicants dropped out already. In this way possible discrimination and the effects of anonymous job application in the second phase of the job assignment process are isolated. To assess the effect of discrimination by the employers / recruiters on the hiring of immigrants I again estimate equation (1) in the treatment and control groups, but now  $y$  denotes whether the applicant is hired or not and the dependent variable indicates the probability to be hired after being invited for an interview. A significant effect of the ethnicity of the applicants indicates discrimination in the second phase of the job assignment process and results in the rejection of hypothesis 4.

<sup>84</sup> In equation (2) AJA is the abbreviation for “anonymous job application”.

<sup>85</sup> See section 5.1.

*Hypothesis 4:*

$H_0$ : Immigrant and native applicants have equal chances to be hired after having a job interview with the employer / recruiter ( $H_0: \beta^{ethn} = 0$ ).

$H_a$ : Immigrant and native applicants do not have equal chances to be hired after having a job interview with the employer / recruiter ( $H_a: \beta^{ethn} \neq 0$ ).

In the control groups this is the second opportunity for employers / recruiters to discriminate, probably employers / recruiters who discriminate immigrants already did this at their first opportunity. In that case there will be no evidence of discrimination in this analysis. This may be in line with both groups of theoretical discrimination models. In the treatment groups this is the first opportunity to discriminate on the basis of the ethnicity of the applicants. The outcomes for the treatment groups show whether the elimination of discrimination in the first phase of the job assignment process also prevents discrimination to occur in the second phase. In that case the desired final outcome is reached: no discrimination on the basis of ethnicity during the job assignment process in the labor market. Discrimination may again indicate taste-based and/or statistical discrimination, but the absence of discrimination in these groups implies that the role of taste-based discrimination is very small during the job assignment process. Taste-based discrimination would arise with certainty in the second phase of the job assignment process, if employers / recruiters are not able to discriminate in the first phase of the job assignment process, because it is impossible that the discriminatory ‘taste’ of employers / recruiters changes between the first and the second phase of the job assignment process.

To investigate the causal effect of anonymous job application on discrimination in the hiring decision of employers I estimate equation (2) again, to test hypotheses 5 and 6. In this case  $y$  denotes again whether the applicant is hired or not and the dependent variable indicates the probability to be hired after being invited for an interview.  $\beta^{effect}$  and  $\beta^{ethn}$  again are the variables of interest. Now  $\beta^{effect}$  denotes the change in probability to be hired for immigrant applicants due to the introduction of anonymous job application. To test hypothesis 6 I apply again Wald tests, to test on the significance of the sum of the ethnicity variable and the variable which indicates the effect of anonymous job application on immigrants’ chances.

*Hypothesis 5:*

*H<sub>0</sub>: Ceteris paribus, the anonymous job application procedure does not change the probability of immigrant applicants to be hired after having a job interview with the employer / recruiter ( $H_0: \beta^{effect} = 0$ ).*

*H<sub>a</sub>: Ceteris paribus, the anonymous job application procedure changes the probability of immigrants to be hired after having a job interview with the employer / recruiter ( $H_a: \beta^{effect} \neq 0$ ).*

*Hypothesis 6:*

*H<sub>0</sub>: Ceteris paribus, the anonymous job application procedure results in a job assignment process in which immigrant and native applicants have equal chances to be hired after having a job interview with the employer / recruiter ( $H_0: \beta^{effect} + \beta^{ethn} = 0$ ).*

*H<sub>a</sub>: Ceteris paribus, the anonymous job application procedure does not result in a job assignment process in which immigrant and native applicants have equal chances to be hired after having a job interview with the employer / recruiter ( $H_a: \beta^{effect} + \beta^{ethn} \neq 0$ ).*

**6.2 Efficiency effects of anonymous job application**

The anonymous job application policy measure may negatively influence the efficiency of the application procedures. The employers / recruiters receive CVs and letters of application which contain less information than in a normal job assignment process. The concealed information prevents them to discriminate on the basis of the applicants' ethnicity during the first phase of the job assignment process.

Norman (2003) theoretically analyses the effects of prohibiting statistical discrimination, he shows that without statistical discrimination there is less information available for employers, because statistical discrimination generates more precise information about workers than equal treatment. In this way statistical discrimination mitigates the matching problem; prohibiting (statistical) discrimination results in more misassignments.<sup>86</sup> Norman (2003) shows on the basis of a few robust examples that the elimination of statistical discrimination is most likely to result in an efficiency loss, which is welfare decreasing.<sup>87</sup> I

<sup>86</sup> This is also in line with Lundberg (1991).

<sup>87</sup> Prohibiting statistical discrimination results in lower total human capital investment costs for workers. This idea is developed by Lundberg and Startz (1983) and already discussed in section 3.2.1. By preventing discrimination to occur the number of investing workers does not change, because there is still imperfect information, but the composition of the investing group changes. The efficiency



concentrate on the first described efficiency loss during the application procedure, which is caused by the prohibition of discrimination and results in more misassignments, due to a loss of information. I expect this loss to occur because anonymous job application prevents employers to (statistically) discriminate workers during the job assignment process. This effect probably decreases the efficiency of the application procedures.

I analyze two ways in which the efficiency loss may reveal itself: a noisier signal of the productivity of the invited applicants and in the total number of interviews. I start with the former. Due to the fact that employers / recruiters receive less information about the applicants, the signal of the productivity (expected productivity) of the applicants is less precise in the anonymous job application procedure. The noisier signal of the applicants' productivity increases the probability that incompetent applicants or applicants unfit for the job are invited for an interview. As a consequence the applicants in the treatment group have a lower probability to be hired, after being invited for an interview. To test the effect on the invited applicants, the estimation of equation (2) with the probability to be hired as the dependent variable is important. In the concerning models the anonymous job application coefficient indicates the influence of the anonymous job application procedure on the probability to be hired for the job, after being invited for an interview. A negative coefficient indicates a lower probability to be hired after being invited for an interview in the treatment part of the model and is a signal of a less efficient application procedure in the treatment part of the model, caused by a noisier signal of applicants' productivity. I test this on the basis of hypothesis 7.

*Hypothesis 7:*

*H<sub>0</sub>: The anonymous job application procedure does not influence the noisiness of the signal of the applicants' productivity during the job assignment process*

*(H<sub>0</sub>:  $\beta^{AJA} = 0$ ).*

*H<sub>a</sub>: The anonymous job application procedure influences the noisiness of the signal of the applicants' productivity during the job assignment process (H<sub>a</sub>:  $\beta^{AJA} \neq 0$ ).*

The second way in which the efficiency loss may reveal itself is a higher number of applicants invited for an interview for the same number of job openings. In that case employers /

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improves, because the marginal costs of investing are lower for the new investors, who are part of the formerly discriminated group. The sum of the former efficiency gain and the efficiency loss due to more misassignments is most likely to be negative according to Norman (2003), which results in an efficiency loss in the market.

recruiters react on the fact that there is less information available for them by inviting more applicants, to obtain more extensive information about more applicants. This implies that firms have to spend more resources for the application procedure of the same number of job openings, which indicates an efficiency loss. I test the effect of anonymous job application on the number of interviews by the following hypothesis:

*Hypothesis 8:*

$H_0$ : *The proportion of job openings over the number of invited applicants for an interview is equal in the experiment groups with and without the anonymous job application procedure ( $H_0: p_{treatment} = p_{control}$ ).*

$H_a$ : *The proportion of job openings over the number of invited applicants for an interview is lower in the experiment groups with the anonymous job application procedure.*

*( $H_a: p_{treatment} < p_{control}$ ).*

With the assistance of Chi-Square tests on equal proportions, checked by Fisher's Exact test in case of a small number of observations, I test whether the fractions of job openings over the number of interviews in the treatment groups are significantly smaller than in the control groups, because a higher number of interviews in relation to the number of job openings results in a lower fraction.<sup>88</sup> In case of a significant lower fraction of job openings over invited applicants the treatment groups, compared to the control groups, hypothesis 8 can be rejected. I expect this to be more likely for the high level jobs, because for those jobs it is more difficult to assess the applicants' abilities on the basis of a letter of application.

### **6.3 Hidden discrimination**

Discrimination during the job assignment process may also play a hidden role, this is the case if immigrant workers adopt their behavior because they expect to be discriminated. In section 2.2 I have discussed the evidence of Langenberg and Lautenbach (2007a, 2007b) and Dagevos and Bierings (2005) in the Dutch labor market. Both articles indicate a higher probability of immigrant workers to be employed at a 'low level job', in comparison with native workers. This may be partly explained by discrimination of employers / recruiters, which prevent them to work at the higher job levels by not hiring them, but the expectation of immigrants to be discriminated, which is also discussed in section 2.2 may also play a role. Immigrants may apply for jobs for which the required education level is lower than their

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<sup>88</sup> Those proportions are the opposite of the ratio: 'number of invited applicants per job opening' which is shown by *table 2* in section 5.2.

highest completed level of education, if they expect to be discriminated. In that case they are ‘over-qualified’. Åslund and Skans (2007) show that less applicants are ‘over-qualified’ in case of an anonymous job application procedure, but this effect is not statistically significant. To analyze this with respect to the experiments in Nijmegen I test the following hypothesis:

*Hypothesis 9:*

$H_0$ : *Immigrant workers are not more often ‘over-qualified’ for the jobs they apply for than native workers ( $H_0: p_{\text{immigrant worker}} = p_{\text{native worker}}$ ).*

$H_a$ : *Direct signals: Immigrant workers are more often ‘over-qualified’ for the jobs they apply for than native workers ( $H_a: p_{\text{immigrant worker}} > p_{\text{native worker}}$ ).*

$H_a$ : *Indirect signals: Immigrant workers are more often ‘over-qualified’ for the jobs they apply for than native workers ( $H_a: p_{\text{immigrant worker}} < p_{\text{native worker}}$ ).*

Over-qualification may reveal itself in two different ways, which I call direct and indirect signals of over-qualification. I explain this with the assistance of the completed education levels of the applicants (high / middle / low) and the required education levels (WO / HBO / MBO) for job openings, which are described in section 5.2 and 5.3.

Direct signals of over-qualification arise if workers with a higher completed education level than the education level required for the job opening apply for the concerning job. The most obvious direct signal which arises is: high educated workers who apply for MBO level job openings. It is important to notice that experience plays a large role, having more experience allows workers to apply for jobs with a higher required education level. This for example allows low educated workers to apply for MBO level jobs, but it may also indicate over-qualification for part of the higher educated applicants. The application of high educated workers for HBO level job openings is for part of the high educated applicants an example of this, because high educated workers have completed a HBO or WO education.<sup>89</sup> As a consequence the second signal is weaker than the first. With respect to the next signal experience plays an even larger role, the third direct signal is represented by middle educated applicants for MBO level job openings.

The other way around, a lower fraction of immigrant applicants for jobs at a higher education level than their highest completed education level is also an indication of over-

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<sup>89</sup> Applicants who completed a HBO education may be over-qualified when they apply for a HBO level job, if they have more experience. The applicants who completed WO are always over-qualified when they apply for a HBO level job.

qualification; this is the second group of signals, indirect signals of over-qualification. In this case immigrant applicants value their experience less than native applicants. There are four indirect signals of over-qualification. The first is a lower fraction of middle educated immigrant workers who apply for HBO level jobs. The second implies the same group of applicants for WO level jobs. Indirect signal three is shown by low educated applicants for a HBO level job. The last signal consists of low educated applicants for WO level job openings. The signals which are based on the experience of the applicants are less strong, because it is impossible to exactly measure the individual importance of the applicants' experience.

I reject hypothesis 9 if the fractions of applicants which indicate the described signals are significantly higher in case of the direct signals of over-qualification and significantly lower in case of the indirect signals of over-qualification. I compare the fractions of applicants which indicate the described signals in all four experiment groups. I test on significant differences with the assistance of Chi-Square tests on equal proportions. Again the results are checked with Fisher's Exact tests in case of a small number of observations.

The applicants did not know whether they were part of the treatment group of the experiment so all experiment groups are similar for this analysis, all applicants have made their choice to apply for a job on a certain level under equal circumstances. Because this analysis only depends on the individual expectations of the applicants and their individual decisions to apply for a job on a certain level there is also no relation between the different experiment groups. Due to the quasi-experimental design of the experiments each experiment contains different applicants, which allows me to analyze the signals in four different groups.

## **7. Results**

This section presents the results of the empirical analysis. The conclusions of all nine tested hypotheses are discussed. The first six hypotheses are directly about the employers' / recruiters' decisions during the two phases of the job assignment process, the invitation for a job interview and the hiring for the job. Hypothesis seven and eight treat indicators of efficiency effects during the job application procedure. The last hypothesis is about signals of hidden discrimination, by relatively more 'over-qualified' immigrant applicants.

### **7.1 The chance to be invited for a job interview**

I start this analysis with some further descriptive information. *Table 5* shows the fractions of native and immigrant applicants invited for a job interview in each experiment group. The table shows for example that 8.8% of the immigrant applicants in treatment group 1 is invited for a job interview. The fraction of invited native applicants is higher in all experiment

groups. In this section I explain whether those differences are the result of discrimination and whether anonymous job application is the cause of fractions which are closer to each other. I start with discussing the first variable of interest, the ethnicity of the applicants. After that I continue with the second variable of interest: the effect of anonymous job application on the probability of immigrants to be invited for an interview. Then I briefly discuss the control variables which are in the linear probability models, including the influence of the other characteristics of the applicants. Finally, I discuss the robustness of the analysis.

*Table 5: Fractions of native and immigrant applicants invited for an interview*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Immigrant applicants	0.088	0.087	0.208	0.162
Native applicants	0.096	0.155	0.226	0.177
# Applicants	663	537	637	756

### 7.1.1 Results of the separate groups

*Table 6* presents the linear probability estimates of being invited for a job interview for the applicants in the four experiment groups. To do this equation (1) is estimated, with the probability to be invited for an interview as the dependent variable.

The estimates in *table 6* show no significant effect of the ethnicity of the applicants in the treatment groups (column 1 and 3). Being an immigrant slightly decreases the probability to be invited for an interview in treatment group 1 (-3%), in treatment group 2 there is a very small positive effect (+1%). I cannot reject hypothesis 1 for the treatment groups, which indicates that anonymous job application seems to work as intended, because the ethnicity of the applicants does not have a statistically significant effect on the probability to be invited for an interview in the treatment groups.

For the control groups (column 2 and 4) the outcomes differ. In the first control group the ethnicity estimate is statistically significant ( $p=0.006$ ), having the immigrant ethnicity significantly decreases the probability to be invited for an interview with 9.2%. This results in the rejection of hypothesis 1 for control group 1. Contrary to that the effect of ‘ethnicity’ is not statistically significant in control group 2, *table 6* indicates a very small positive effect (+1.1%). Hypothesis 1 cannot be rejected for control group 2.

*Table 6: Linear probability estimates of being invited for a job interview separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	-0.030 (0.032)	-0.092*** (0.033)	0.010 (0.044)	0.011 (0.042)
Sex	0.016 (0.029)	0.078** (0.034)	0.017 (0.039)	0.037 (0.032)
Age: younger than 30	-0.044 (0.030)	-0.013 (0.037)	-0.086** (0.044)	-0.098*** (0.036)
Age: older than 45	-0.090*** (0.028)	-0.010 (0.037)	-0.132*** (0.037)	-0.124*** (0.031)
Low educated	-0.016 (0.028)	-0.062 (0.049)	0.074 (0.115)	-0.039 (0.042)
High educated	-0.022 (0.024)	-0.034 (0.034)	-0.034 (0.039)	0.014 (0.035)
# Observations	653	522	618	732
R-squared	0.1084	0.1401	0.1542	0.1021

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

Because the evidence in the previous paragraph is mixed I analyze whether employers / recruiters are more likely to discriminate with respect to the invitation of applicants for an interview for job openings on a higher or lower job level. I divide the sample in two groups to examine the heterogeneous effects of discrimination by employers / recruiters on the different job levels. The first group consists of the job openings for which a completed MBO education is required, for the second group a completed HBO or WO education is required.<sup>90,91</sup> *Table A3* and *A4* in the appendix show the linear probability estimates for the four experiment groups, specified to the two job level groups. I discuss the results with respect to the ethnicity variable.

In both treatment groups there are no statistically significant heterogeneous effects with respect to the ethnicity of the applicants, employers / recruiters are not more likely to

<sup>90</sup> The groups are based on the required education level for the various job openings. Constructing groups on the basis of the highest completed education levels of the applicants would give unreliable results due to the influence of the applicants' experience, which may decrease the influence of the highest completed education level for part of the applicants.

<sup>91</sup> Breaking up the HBO and WO level jobs into two groups would result in unreliable conclusions, because the WO group is reasonably small, while the MBO group is very large. Especially the difference in the number of job openings would cause reliability problems.

discriminate in case of MBO or HBO/WO level job openings. In the first control group all applicants are discriminated, on the MBO level immigrants have a 7.6% lower probability to be invited for an interview and on the HBO/WO this probability is 13.4% lower. Only the estimate for the MBO level job openings is statistically significant ( $p=0.025$ ).<sup>92</sup> This indicates that the evidence of discrimination in the first control group is especially based on the statistically significant results on the MBO level. In the second control group the largest heterogeneous effect arises. Immigrant applicants have a statistically significant ( $p=0.098$ ) higher probability (7.9%) to be invited for an interview if they apply for MBO level jobs. Contrary to that they are disadvantaged (-16.3%) when they apply for a job on the HBO/WO level, this ethnicity coefficient is also statistically significant ( $p=0.035$ ).

In addition to the previous general analysis hypothesis 1 cannot be rejected for the HBO/WO level jobs in control group 1, as a consequence of a lack of significant evidence. Contrary to that hypothesis 1 can be rejected for the MBO level jobs in control group 1. For both the MBO and HBO/WO level jobs in control group 2 hypothesis 1 can be rejected too. On the MBO level hypothesis 1 is rejected due to significant reverse discrimination of immigrant applicants.<sup>93</sup>

### **7.1.2 Results of the combined models**

Because it is not possible to indicate a causal relationship between the previous evidence of discrimination in (part of) the control groups and the more equal chances in the treatment groups I turn to the second group of linear probability models, estimated by equation (2). *Table 7* shows the estimates. Those models always consist of two of the separate groups, in various combinations. I call those combined models ‘model 1’, ‘model 2’, ‘model 3’, and ‘model 4’

As described in section 4.3, two experiments have taken place. In experiment 1 the treatment group contains the first group of departments, while the control group contains the second group of departments. For the second experiment the same groups of departments are investigated, but the treatment and control groups are turned around. The time-fixed models are based on those two experiments and contain the above mentioned groups. This implies that in the time-fixed models the results of a treatment and a control group at the same moment, but each containing different departments with different employers / recruiters, are

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<sup>92</sup> The p-value for the ethnicity coefficient on the HBO/WO level job openings is 0.112.

<sup>93</sup> In case of reverse discrimination the native applicants are disadvantaged, employers / recruiters give (significant) preference to immigrants, as a consequence the immigrants’ probability to be invited or hired is higher.

compared. This is an important disadvantage of those results, because discriminatory behavior during the job assignment process probably depends on the hiring policy applied in a certain department and on the employers / recruiters who implement this policy. Due to the fact that exactly the same research groups are turned around in experiment 2 it is also possible to investigate the effects inside the same group of departments, those are the department-fixed models. In that case the group of the departments at which the job openings are, is the same in both experiment groups which are compared in the combined model, but now the period in which the experiment takes place differs. In those models the hiring policy in the group of departments and the employers / recruiters who implement this policy are the constant factors. On the basis of the previous reasoning the analysis of the department-fixed models (model 3 and 4) is the most important, because discriminatory behavior probably depends on a certain department and the employers / recruiters at that department.

I start with analyzing the time-fixed models and after that I continue with the department-fixed models. The first experiment is estimated in model 1, the first time-fixed model. The estimates of the first experiment are very similar to that of the first control group. Striking is that the coefficient which indicates the influence of the ethnicity of the applicants is statistically significant at a 1% significance level ( $p=0.005$ ). In experiment 1 the probability to be invited for an interview is 9.3% lower for immigrant applicants. Hypothesis 1 can be rejected for experiment 1, there is significant evidence of discrimination. Hypothesis 2 is the next subject of analysis. Anonymous job application increases the probability of immigrants to be invited for an interview with 6.1%, but this effect is not statistically significant, hypothesis 2 cannot be rejected. As *table 7* shows, hypothesis 3 cannot be rejected too, there is no evidence of statistically significant discrimination in the group of departments with anonymous job application procedures. I conclude that in experiment 1 the anonymous job application procedure decreases the effect of discrimination on the basis of ethnicity during the first phase of the job assignment process, but this effect is not statistically significant. In spite of that the desired result is reached, there is no statistically significant discrimination during the first phase of the job assignment process in the experiment group with anonymous job application procedures, while there is significant evidence of discrimination in the group without the policy measure.

For experiment 2, estimated by the second combined model, which is also a time-fixed model, the estimates are very similar to the estimates of the two separate groups of experiment 2. This implies that there is no significant evidence of discrimination on the basis



of the applicants' ethnicity (positive effect of 1.1%), hypothesis 1 cannot be rejected. As a consequence the effect of the anonymous job application policy on immigrants' chances is negligible and of course not statistically significant, hypothesis 2 cannot be rejected too. The final result is also a non-discriminatory job assignment process with anonymous job application, because hypothesis 3 cannot be rejected.

In models 3 and 4, the department-fixed models, the decisions taken in the same departments by the same employers / recruiters are compared, in a situation with and without anonymous job application. Evidence of discrimination in the department-fixed models indicates that discrimination occurs in the concerning group of departments. The same applies for the effectiveness of anonymous job application in eliminating discrimination. Important is that there are no time-effects between the two experiments, because in those models the research period is not the same. As I have discussed in section 5.4 I assume there are no time effects.

In *table 7*, model 3 shows the results for the first group of departments, this combined model consists of treatment group 1 and control group 2, so it is a department-fixed model.<sup>94</sup> There is no evidence to reject hypothesis 1 for this group of departments, the effect of the ethnicity variable is positive (+1.2%) and not statistically significant. The anonymous job application procedure reduces the probability to be invited for an interview for immigrant workers in this group (-4.4%), but this effect is not statistically significant. The null hypothesis of hypothesis 2 cannot be rejected too. The test on the combined effect of the two above discussed variables shows an effect not significantly different from zero, hypothesis 3 cannot be rejected. I conclude that there is no evidence of discriminatory behavior of employers / recruiters on the basis of the applicants' ethnicity in the first group of departments. This is confirmed by the separate results of control group 2, which represents the control part of this model. In the absence of discrimination the influence of the anonymous job application policy measure on the immigrants' chances to be invited for an interview is also not statistically significant. Of course this results in a non-discriminatory first phase of the job assignment process with and without anonymous job application procedures.

The estimates for the second group of departments are shown in column 4 of *table 7*. This combined model, model 4, consists of treatment group 2 and control group 1, and is again a department-fixed model.<sup>95</sup> Immigrants have a 9.3% lower probability to be invited for an

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<sup>94</sup> Departments: "Stadsbedrijven", "Grondgebied" and "Wijk en Stad", see section 4.3.

<sup>95</sup> Departments: "Inwoners", "Concernstaf", "Bestuursstaf" and "Brandweer", see section 4.3.

interview in this group of departments. This effect is statistically significant ( $p=0.005$ ), hypothesis 1 can be rejected. The order of magnitude of discrimination in this group of departments is very similar to what Åslund and Skans (2007) have found in their anonymous job application experiment in Gothenburg, they find a negative effect of 9% for applicants with a non-Western origin to be invited for an interview. Carlsson and Rooth (2007) have also found evidence of discrimination of the same magnitude; they find a 10% lower probability of being called back for an interview for applicants with a Middle-Eastern sounding name in Sweden.

The estimate which denotes the effect of anonymous job application on immigrants' chances is positive (+10.3%) and statistically significant ( $p=0.052$ ), hypothesis 2 can be rejected. The latter change in probability to be invited is larger than that of the having the 'immigrant ethnicity', which suggests that the anonymous job application procedure completely eliminates discrimination of immigrants in the second group of departments. The testing of hypothesis 3 formally confirms this: hypothesis 3 cannot be rejected. With respect to this group of departments there is evidence of a significant causal effect of anonymous job application on the discriminatory behavior of employers / recruiters, which results in a non-discriminatory first phase of the job assignment process in the part of the model with the anonymous job application policy measure, contrary to the other part. I conclude that the employers / recruiters in the second group of departments significantly discriminate immigrants during the job assignment process. The estimation of equation (1) for control group 1 confirms that employers / recruiters behave discriminatory in this group of departments. The introduction of anonymous job application eliminates the discriminatory behavior of employers / recruiters, which results in a non-discriminatory first phase of the job assignment process.

Table 7: Linear probability estimates of being invited for a job interview combined models<sup>96</sup>

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	-0.093*** (0.033)	0.011 (0.042)	0.012 (0.041)	-0.093*** (0.033)
Anonymous job application	0.378 (0.352)	-0.104 (0.159)	0.330 (0.369)	-0.047 (0.050)
Anonymous job application * Ethnicity	0.061 (0.045)	0.000 (0.059)	-0.044 (0.052)	0.103** (0.053)
Sex	0.045** (0.022)	0.028 (0.025)	0.028 (0.022)	0.045* (0.026)
Age: younger than 30	-0.029 (0.023)	-0.091*** (0.028)	-0.072*** (0.024)	-0.049* (0.029)
Age: older than 45	-0.055** (0.023)	-0.127*** (0.024)	-0.108*** (0.022)	-0.077*** (0.026)
Low educated	-0.037 (0.025)	-0.025 (0.039)	-0.026 (0.025)	-0.027 (0.048)
High educated	-0.028 (0.020)	-0.009 (0.026)	-0.004 (0.022)	-0.034 (0.024)
# Observations	1,175	1,350	1,385	1,140
R-squared	0.1254	0.1297	0.1152	0.1528
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.321	0.780	0.313	0.804
Discriminatory without AJA	Yes	No	No	Yes
Discriminatory with AJA	No	No	No	No

Notes: Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity \* anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

Because the estimation of equation (1) for the separate experiment groups showed heterogeneous effects I divide the samples of the four combined models according to the same groups,<sup>97</sup> specified to the required education levels, to check the results for heterogeneous effects. Table A5 and A6 in the appendix show the models specified to the required education

<sup>96</sup> The Ts and Cs in row 2 indicate the separate treatment and control groups. In this way table 7 for example shows that model 1 consists of the separate groups 'treatment group 1' and 'control group 1'.

<sup>97</sup> Two groups, the jobs for which an MBO level education is required and the jobs for which an HBO or WO level education is required, see section 7.1.1 and footnotes 90 and 91.

levels. Below I discuss the heterogeneous effects concerning the applicants' ethnicity, the effects of anonymous job application on the probability of immigrants to be invited for an interview and the anonymous job application coefficient.

Model 1, about the first experiment, which is a time-fixed model, indicates a statistically significant ( $p=0.015$ ) negative estimate (-8%) for the MBO level jobs, while the HBO/WO level estimate is also negative (-12.9%), but not statistically significant.<sup>98</sup> So only on the MBO level there is significant evidence of discrimination in experiment 1, hypothesis 1 can be rejected only for jobs on this education level. With respect to the effect of anonymous job application on the immigrants' probability to be invited there are no heterogeneous effects, the effect is for both education levels non-significantly positive, which does not result in the rejection of hypothesis 2. The testing of hypothesis 3 does not result in heterogeneous effects, hypothesis 3 cannot be rejected for both job levels.

The second experiment is treated by model 2, the other time-fixed model. This model shows again heterogeneous effects. On the MBO level immigrant applicants have almost statistically significant<sup>99</sup> higher chances (+7.3%) to be invited for an interview. Contrary to that on the HBO/WO level immigrants are statistically significantly ( $p=0.020$ ) disadvantaged, their probability to be invited for an interview is 17.8% lower. Hypothesis 1 can be rejected only for the HBO/WO level job openings. The effect of the anonymous job application policy measure on immigrants' chances is negative on the MBO level, anonymous job application decreases the influence of discrimination, but not statistically significantly. On the HBO/WO level this effect is positive and statistically significant ( $p=0.040$ ). There is significant evidence that anonymous job application reduces discrimination on the HBO/WO level jobs in model 2, hypothesis 2 can be rejected only for the HBO/WO level jobs. On both job levels there is no discrimination after introducing anonymous job application, hypothesis 3 cannot be rejected for both job levels.

I continue with the heterogeneous effects in the two department-fixed models which are the main subject of analysis, models 3 and 4. I start with analyzing model 3, which treats the first group of departments. Again important heterogeneous effects arise. Immigrant workers are almost significantly positively discriminated on the MBO level,<sup>100</sup> they have a 7.3% higher probability to be invited for an interview. On the other hand immigrants have a 18% lower probability to be invited when they apply for a HBO/WO level job, this effect is

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<sup>98</sup> The p-value of the ethnicity coefficient in model 1 on the HBO/WO level is 0.121.

<sup>99</sup> The p-value of the ethnicity coefficient in model 2 on the MBO level is 0.122.

<sup>100</sup> The p-value of the ethnicity coefficient in model 3 on the MBO level is 0.121.

statistically significant ( $p=0.018$ ). This only results in the rejection of hypothesis 1 for the HBO/WO job levels. Those effects are largely confirmed by the estimation of the separate control group 2, which shows a significant positive ethnicity coefficient on the MBO level and a significant negative ethnicity coefficient on the HBO/WO level.

The negative effect (-10.3%) of anonymous job application on the immigrants' chances on MBO level is statistically significant ( $p=0.072$ ). The reverse discrimination of immigrant applicants is statistically significantly reduced by introducing anonymous job application. The influence of anonymous job application on the immigrants' chances (+12.3%) on the HBO/WO level is not statistically significant. The effect is positive, so anonymous job application again reduces the effect of discrimination. Hypothesis 2 can be rejected for the jobs on the MBO level, but cannot be rejected for both jobs on the HBO/WO level. With respect to the result of introducing the anonymous job application procedure there are again no heterogeneous effects, for both job levels hypothesis 3 cannot be rejected.

I conclude that in the first group of departments immigrants are non-significantly positively discriminated on the MBO level, while they are significantly discriminated on the HBO/WO level. Anonymous job application reduces both forms of discrimination, but this effect is only statistically significant on the MBO level. The result of introducing anonymous job application is a non-discriminatory first phase of the job assignment process on both job levels.

In the fourth model, which is about the second group of departments, immigrants are discriminated on both education levels, on the MBO level they have a 7.7% lower probability to be invited and on the HBO/WO level this probability is 12.8% lower. Only the effect on the MBO level is statistically significant ( $p=0.023$ ).<sup>101</sup> Hypothesis 1 can be only rejected for the MBO level jobs. The tests of the separate control group 1 confirm the results for both education levels. With respect to the effect of the anonymous job application policy on immigrants' chances there are no heterogeneous effects, both coefficients are positive and not statistically significant. This implies that anonymous job application does not significantly reduce discrimination, hypothesis 2 cannot be rejected for both education levels.

I conclude that employers / recruiters in the second group of departments significantly discriminate immigrants on the MBO level. Anonymous job application reduces this effect, but not significantly. However, the result of introducing anonymous job application is on both

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<sup>101</sup> The discrimination on the HBO/WO level is almost statistically significant, the p-value of the ethnicity coefficient is 0.119.

job levels a non-discriminatory first phase of the job assignment process, hypotheses 3 cannot be rejected for both job levels.

The anonymous job application coefficient ( $\beta^{AJA}$ ) shows a statistically significant heterogeneous effect in model 4. On the MBO level this coefficient is significantly ( $p=0.029$ ) positive and on the HBO/WO level it is significantly negative ( $p=0.002$ ). This coefficient indicates the difference in probability to be invited for an interview between the treatment and the control group part of the model. I expect the statistically significant coefficients to be caused by measurement errors, which arise due to differences in the number of job specific dummies in the treatment and control group parts of the heterogeneous versions of model 4. As discussed the job specific dummy variables include the effects of differences in the number of applicants per job opening and of differences in the number of interviews per job opening, but in this case the number of job openings itself is also very unequal.<sup>102</sup> In treatment group 2 the number of HBO/WO level job openings is overrepresented and in control group 1 the number of MBO level job openings is overrepresented, as discussed in section 5. This results in a larger number of jobs in the control group on the MBO level and in a larger number of jobs in the treatment group on the HBO/WO level. As a consequence of the relationship between the job specific dummies and the anonymous job application coefficient, which divides the job specific dummies in two groups, the much higher number of job specific dummies in the concerning part of the model results in a lower probability to be invited for the applicants for those jobs. After excluding the job specific dummies the significant effect of the anonymous job application coefficient disappears, while the other coefficients (and their significance) are largely unchanged.

Summarizing the analysis of the four combined models and the separate groups I have found the following main results in the first phase of the job application process. As already indicated the results inside the same groups of departments, the department-fixed models, are the most important, because in that case the same employers / recruiters take the decisions during the job assignment process, in both the treatment and control group part of the combined model. So I stick to department-fixed results in this short conclusion, those results are supported by the other combined models and the separate models. There seems to be no discrimination in the first group of departments, because the general analysis shows no

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<sup>102</sup> On the MBO level there are 7 job openings in the treatment part of the model and 11 in the control part of the model. On the HBO/WO level there are 17 job openings in the treatment part of the model and 9 in the control part of the model. After excluding the perfect predicting job specific dummies, on the MBO level the proportion is 5 to 9 and on the HBO/WO level the proportion is 15 to 8.

statistically significant effect of the ethnicity coefficient. However, turning to the analysis of the heterogeneous models shows that there is almost significant positive discrimination of immigrants on the MBO level jobs (+7.3%), while they are significantly negatively discriminated on the HBO/WO level jobs (-18%). The general analysis of the second group of departments shows a significantly lower probability (-9.3%) to be invited for a job interview for immigrants. Looking at the different required education levels shows that on both job levels immigrants are discriminated in this group of departments, but only significantly on the MBO level (-7.7%).

On the basis of the results of estimating equation (2) it is possible to draw conclusions about the ability of anonymous job application to eliminate discrimination, in this way a causal relationship is indicated. Anonymous job application reduces discrimination during the job assignment process in all circumstances in which discrimination arises, this concerns also non-significant discrimination of immigrant or native applicants. The discussed outcomes indicate that for anonymous job application to significantly influence the immigrant applicants' chances there has to be strong evidence of discrimination first. I shortly discuss those cases in the department-fixed models. The results show that the reverse discrimination of immigrants on the MBO level in the first group of departments (model 3) is significantly reduced by anonymous job application. On the HBO/WO job level in the first group of departments anonymous job application does not significantly decrease the effect of discrimination. In the general analysis of the second group of departments (model 4) anonymous job application again significantly reduces the effects of discriminatory behavior of employers / recruiters. On the MBO level of the second group of departments the effect of anonymous job application on immigrants' chances is not statistically significant. In all models the result of introducing anonymous job application is a non-discriminatory first phase of the job assignment process. This indicates that, in spite of the fact that not in all cases the effect of anonymous job application on the immigrants' chances is statistically significant, it always has the desired final result in this experiment.

I conclude that with respect to the significant influence of the anonymous job application policy measure on immigrants' probability to be invited the results are mixed. The policy measure always reduces discrimination, but this effect is not in all cases statistically significant. However, in both the models in which the first phase of the job assignment process is discriminatory without anonymous job application and in the models in which this

is not the case, anonymous job application results in a non-discriminatory first phase of the job assignment process.

### 7.1.3 The influence of the control variables

In this section I briefly discuss the other coefficients in the general linear probability models, starting with the variable ‘anonymous job application’. The anonymous job application coefficient denotes the effect of the policy measure on the probability to be invited for an interview of the applicants who apply for a job in the treatment group part of a model. A positive effect indicates a higher probability to be invited for the applicants who take part in an anonymous job application procedure, a negative effect indicates the opposite. Important to notice is that the number of applicants for a certain job opening and the number of interviews per job opening, which are shown in *table 2*, do not influence this variable, because those effects are already covered by the job specific dummies. In none of the general models the anonymous job application variable is statistically significant.

I continue with discussing the influence of the other characteristics of the applicants on the probability to be invited for a job interview, starting with the applicants’ gender. In the four experiment groups and the combined models the probability to be invited for an interview is between the 2 and 8% higher for women, the coefficient is statistically significant in control group 1 ( $p=0.029$ ), model 1 ( $p=0.041$ ) and model 4 ( $p=0.089$ ). This is a striking result, because in the empirical literature there is a lot of evidence of gender discrimination at the cost of women.<sup>103</sup> The age of the applicants plays an important role in the first phase of the application procedure. Young (younger than 30) applicants are disadvantaged (between the 1 and 10% lower probability to be invited) when they send their letter of application, this effect is statistically significant in both groups of experiment 2 ( $p=0.050$  and  $p=0.007$ ) and the models 2, 3 and 4 ( $p=0.001$ ,  $p=0.003$  and  $p=0.089$ ).<sup>104</sup> Old (older than 44) applicants are even more disadvantaged (1-13%), all coefficients are negative for this group and in general larger than for young applicants. Except for control group 1 the effect is statistically significant in all linear probability models (all under a 1% significance level, except for model 1;  $p=0.016$ ). I conclude that there is strong evidence of age discrimination; both young and old applicants

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<sup>103</sup> See for example Riach and Rich (2002), Riach and Rich (1987), Åslund and Skans (2007), Edin and Lagerstrom (2006), Neumark (1996), Nunes and Seligman (2000) and Goldin and Rouse (2000) for recent evidence of gender discrimination. It is possible that the fact that the experiment takes place in the public sector plays a role, as discussed in section 5.4 discrimination probably depends on the main goal(s) in concerning sector.

<sup>104</sup> As discussed in section 5.4 this effect may be partly explained by the underlying or third variable experience, the young applicants lack experience.



are discriminated, while the effect for old applicants is much stronger and more often statistically significant.<sup>105</sup> The influence of the applicants' education level on their probability to be invited is not statistically significant, probably the experience of the applicants plays a large role. Being low or high educated has a negative effect on the probability to be invited for an interview in comparison with middle educated applicants, but those effects are small and not statistically significant.<sup>106</sup>

#### **7.1.4 Robustness**

The results shown in section 7.1 are based on linear probability models. This may appear unreliable, because the probability to be invited differs a lot between the different job openings. However, checking the results by using probit regression models confirms the estimates (and their significance), for both the separate and combined models.

Another problem may be the fact that certain employers / recruiters or certain departments are more discriminatory than others (due to personal racial preferences or 'personal' negative stereotypes), as a consequence correlation between the error terms may arise. To prevent those effects to influence the outcomes I have applied White Heteroskedasticity-Consistent standard errors in all linear probability models.

Since all the linear probability models include dummies for each specific job, all particularities common to all applicants to a specific job are removed. The most obvious examples are the number of interviews per job opening and the number of applicants per job opening, but for example also for the possibility that many workers apply for a job opening that was already from the beginning to be filled by someone known by the employer / recruiter, so that much less applicants were interviewed, is covered.

The job specific dummies which are perfect predictors of an invitation for an interview or not, are excluded in all the linear probability models. Including those observations would bias the results because in that case the individual characteristics of the applicants (ethnicity and the control variables) do not influence the outcome of the decision. The observations in the sample with missing information are also excluded because they may also bias the results. The missing information may predict a rejection and probably decreases the probability to be invited, because employers / recruiters have less information about the concerning applicant.

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<sup>105</sup> This is in line with Riach and Rich (2002), who conclude in their literature review of audit studies that there is significant evidence of age discrimination.

<sup>106</sup> The heterogeneous estimations indicate that being high educated increases the probability to be invited for a HBO/WO job, *table A4* and *A6* in the appendix show this.

As a consequence of excluding those observations the number of observations in the linear probability models is smaller than in the descriptive tables of section 5.

Finally, I have checked the results for heterogeneous effects between the different required education levels, those results are already discussed.

## 7.2 The chance to be hired for the job

In the previous section I have analyzed whether the ethnicity of the applicants influences their probability to be invited for a job interview. The logical next step is looking at the final result, which applicants are hired for the job. I start again with some further descriptive information, showed by *table 8*.

*Table 8: Fractions of hired native and immigrant applicants from the invited applicants*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Immigrant applicants	0.303	0.444	0.240	0.263
Native applicants	0.315	0.471	0.217	0.212
# Invited applicants	63	77	140	132

*Table 8* shows the fractions of hired immigrant and native applicants of the total numbers of invited immigrant and native applicants in the concerning experiment groups. The sample which only includes the applicants invited for an interview is analyzed. *Table 8* shows for example that 30.3% of the immigrant applicants who are invited for an interview in treatment group 1 are hired. In the groups of the first experiment the fractions of hired native applicants are slightly higher, which may indicate discrimination, but in the second experiment the fractions of immigrant applicants are higher. To analyze possible discrimination and the effects of anonymous job application on the immigrants' probability to be hired I test hypothesizes 4, 5 and 6. I start the analysis again with the two main variables of interest, the ethnicity of the applicants and the effect of anonymous job application on discrimination. After that I briefly discuss the control variables in the linear probability models, including the applicants' other characteristics. I end with another section about robustness.

### 7.2.1 Results of the separate groups

In *table 9* equation (1) is estimated for the four experiment groups, but in this case with the probability to be hired as the dependent variable. The estimates denote the probability to be hired for the applicants who are invited for an interview. There is substantial statistical uncertainty in the following analysis, as a consequence of the small number of observations. Especially when analyzing the subgroups (e.g. immigrants, women or old applicants) and

heterogeneous effects (specified to the required education levels) the number of observations is small.

The estimates of the ethnicity of the applicants are in all four experiment groups positive and not statistically significant. I conclude that I cannot reject hypothesis 4, immigrant and native applicants do not have unequal chances to be hired after being invited for an interview.

*Table 9: Linear probability estimates of being hired for a job separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	0.057 (0.261)	0.046 (0.215)	0.116 (0.119)	0.018 (0.122)
Sex	-0.131 (0.212)	0.144 (0.200)	0.089 (0.093)	0.100 (0.115)
Age: younger than 30	-0.110 (0.237)	0.299* (0.180)	0.040 (0.128)	-0.079 (0.131)
Age: older than 45	-0.161 (0.213)	-0.121 (0.174)	-0.247*** (0.090)	0.118 (0.127)
Low educated	-0.144 (0.271)	-0.351 (0.456)	- -	-0.160 (0.164)
High educated	-0.006 (0.256)	-0.490** (0.247)	-0.024 (0.129)	-0.213* (0.118)
# Observations	60	63	129	124
R-squared	0.0824	0.2404	0.1555	0.0891

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. There is no dummy variable included for applicants with a low education in treatment group 2, because being low educated perfectly predicts a negative outcome in this model.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

I have again checked the results for heterogeneous effects between the different required education levels for the different job openings. To do that I have again divided the application procedures in two groups, the MBO level job openings and the HBO and WO level job openings. *Table A7* and *A8* in the appendix show the results. I discuss the differences with respect to the ethnicity of the applicants. The signs of the coefficients show that immigrants are more often advantaged on the MBO level and more often disadvantaged on the HBO/WO level. Because none of those coefficients is statistically significant I conclude that there are no noticeable heterogeneous effects.

### 7.2.2 Results of the combined models

To analyze whether a causal relationship between discrimination in the second phase of the job assignment process and anonymous job application exists I estimate equation (2) with the probability to be hired, after being invited for an interview, as the dependent variable. *Table 10* shows the estimates of the four combined models, which represent the two experiments and the two groups of departments. In none of the models there is significant evidence of discrimination on the basis of ethnicity, hypothesis 4 cannot be rejected for all models. As a consequence the effects of anonymous job application on the immigrants' probability to be hired are not statistically significant, hypothesis 5 cannot be rejected for all models. The obvious result is a non-discriminatory second phase of the job assignment process also in the parts of the model with anonymous job application procedures, because hypothesis 6 cannot be rejected for all models.

I briefly describe both the time-fixed and department-fixed models, starting with the former. For experiment 1 the ethnicity coefficient is positive (+2.1%) and for experiment 2 the coefficient is negative (-0.041). There seems to be no relation between the effect of anonymous job application on the immigrants' chances and the sign of the ethnicity coefficient in this phase of the job assignment process, because both coefficients for model 1 and 2 are positive (+9.6% and +13.4%). In spite of that the final result in the experiment groups with anonymous job application is still non-discriminatory.

As discussed, the department-fixed models estimated by models 3 and 4 are the main subjects of analysis. In both models the coefficients are positive, but very small (+0.5% and +2%). The estimation of equation (1) for the separate control groups confirms that there is no significant discrimination, neither in the first group of departments, nor in the second. Anonymous job application again positively influences the chances of immigrants in model 3 and 4, with 13.1% in the former and 6.3% in the latter model. This results in a non-discriminatory second phase of the job assignment process, with and without anonymous job application.

Table 10: Linear probability estimates of being hired for a job combined models

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	0.021 (0.200)	-0.041 (0.125)	0.005 (0.126)	0.020 (0.200)
Anonymous job application	-0.413 (0.358)	-0.097 (0.170)	-0.034 (0.046)	-0.516* (0.274)
Anonymous job application * Ethnicity	0.096 (0.299)	0.134 (0.166)	0.131 (0.247)	0.063 (0.233)
Sex	0.038 (0.132)	0.107 (0.070)	0.036 (0.102)	0.132 (0.083)
Age: younger than 30	0.145 (0.139)	0.002 (0.087)	-0.065 (0.109)	0.114 (0.101)
Age: older than 45	-0.144 (0.132)	-0.093 (0.073)	0.032 (0.109)	-0.184** (0.079)
Low educated	-0.204 (0.214)	-0.126 (0.131)	-0.173 (0.141)	-0.310* (0.180)
High educated	-0.267 (0.162)	-0.107 (0.089)	-0.135 (0.121)	-0.142 (0.167)
# Observations	124	255	183	195
R-squared	0.1278	0.0948	0.0666	0.1870
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.596	0.405	0.526	0.503
Discriminatory without AJA	No	No	No	No
Discriminatory with AJA	No	No	No	No

Notes: Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity\*anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution. In case of a smaller sample this is checked by the F-distribution.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

Now I turn again to checking the results for heterogeneous effects. Table A9 and A10 show the results of estimating equation (2), specified to the MBO required education level and the HBO/WO required education levels. In all four models no statistically significant heterogeneous effects arise with respect to the ethnicity of the applicants. Striking are the signs of the ethnicity coefficients and the coefficients which indicate the effect of anonymous job application on the immigrants' chances. If the job openings are specified to the required education level the anonymous job application policy measure again reduces the effect of discrimination in most models, but none of the effects is statistically significant. In all models

the anonymous job application policy measure results in a non-discriminatory second phase of the job assignment process. I discuss the heterogeneous effects of the anonymous job application coefficient in the next section, because it concerns efficiency effects.

On the basis of the department-fixed models 3 and 4 I conclude that there is no discrimination during the second phase of the job assignment process, in both groups of departments there is no significant evidence of discriminatory behavior of employers / recruiters with respect to applicants' ethnicity. The estimations of the separate groups confirm this. Testing on the combined effect of the ethnicity coefficient and the coefficient which indicates the effect of anonymous job application on the immigrants' chances, shows that in the anonymous job application parts of the models the second phase of the job assignment process is also non-discriminatory. Because this analysis is about the same applicants and employers / recruiters as in the previous section it is possible to draw a few conclusions about the behavior of the latter. In both groups of departments the employers / recruiters, who behave significantly discriminatory at least at one job level in the first phase of the assignment process, do not discriminate on the basis of the applicants' ethnicity in the second phase of the application process, which becomes evident in the hiring decision.

In the control group parts of the combined models employers / recruiters already had an opportunity to discriminate during the first phase of the job assignment process, as discussed in the empirical analysis section. It is obvious that those employers / recruiters do not discriminate again on the basis of the applicants' ethnicity at their second opportunity, the hiring the decision. This is confirmed by the data for both groups of departments. The immigrant applicants who pass the first round in those parts of the models, the invitation for an interview, 'survived' the discrimination on the basis of ethnicity already.

The employers / recruiters in the treatment group parts of the combined models were not able to discriminate due to the anonymous job application policy measure during the first phase of the job assignment process. The hiring decision is their first opportunity to discriminate, but according to the results those employers / recruiters also do not discriminate in the second phase of the application process. This is confirmed by the tests of both separate models of the treatment groups, which also denote no statistically significant discriminatory behavior of employers / recruiters on the basis of applicants' ethnicity. This implies that eliminating discriminatory behavior of employers / recruiters during the first phase of the job assignment process results in the elimination of discrimination during the whole job assignment process.

This result is in line with the outcomes of Goldin and Rouse (2000), who have also found an effect of blind auditions in the preliminary rounds on the final result. It contradicts the evidence of Åslund and Skans (2007), who have found evidence of discrimination in both phases of the job assignment process, but they also did not find a significant effect of anonymous job application on the employers' decisions in the second phase of the job assignment process.<sup>107</sup>

The empirical results confirm that taste-based discrimination plays a minor role in the job assignment process, because taste-based discrimination would arise in the second phase of the assignment process, if employers / recruiters were not able to discriminate in the first phase. This situation occurs in the treatment group parts, employers / recruiters were not able to discriminate in the first phase of the job assignment process in those parts of the models. The absence of discrimination in the treatment groups of the second phase of the job assignment process indicates that discrimination is eliminated between the two phases of the job assignment process. This is only possible in case of statistical discrimination, as discussed in section 6.1. I conclude that the discrimination of immigrants during the first phase of the job assignment process is theoretically only explainable by the models of statistical discrimination. Incorporating the results in those models implies that the prior beliefs of employers about immigrants are no longer negative at the start of the second phase of the job assignment process or the precision of the observing the immigrants' productivity is no longer worse.

### **7.2.3 The influence of the control variables**

Now I briefly discuss the other coefficients in the general linear probability models, estimated by equation (1) and equation (2). I discuss the anonymous job application coefficient in the next section, because this coefficient is important to assess the efficiency effects of anonymous job application, as discussed in section 6.2.

I start with discussing the gender of the applicants. Being a woman improves the probability (4-14%) to be hired, except for treatment group 1 (-13%). However, none of the coefficients is statistically significant.<sup>108</sup> The effects of being a young applicant are mainly

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<sup>107</sup> Åslund and Skans (2007) included all applicants in their analysis of the hiring decision; they also included the applicants who were not invited for an interview. In fact they investigated discrimination during both phases of the job assignment process in this way, which probably causes the differences in outcomes.

<sup>108</sup> The heterogeneous models do show statistically significant sex coefficients. Model 2 and model 3 on the MBO level show significant positive coefficients, in contrast to that model 1 on the HBO/WO level shows a significant negative coefficient.

positive, with one statistically significant ( $p=0.104$ ), positive coefficient for control group 1. Older applicants have again a smaller probability to be hired, except for model 3. Two coefficients are statistically significant (model 4,  $p=0.021$  and treatment group 2,  $p=0.007$ ), so those effects are also less strong than that in case of the interview invitation. A low education decreases the probability to be hired, but only statistically significantly ( $p=0.085$ ) in model 4. A high education decreases the probability to be hired in the general analysis. This negative effect is statistically significant in control group 1 ( $p=0.054$ ) and control group 2 ( $p=0.074$ ).<sup>109</sup> I conclude that the influence of the control factors is smaller in the second phase of the job assignment process, just like the influence of the ethnicity of the applicants. The exception is the education level, which is more important in the second phase of the job assignment process than in the first phase. This especially becomes evident in the heterogeneous models, which show statistically significant coefficients.<sup>110</sup>

#### 7.2.4 Robustness

For the analysis of the second phase of the job assignment process a smaller sample is used, only the applicants who are invited for an interview are included, because the other applicants were not able to be hired anymore, after not being invited for an interview. In this way the effects of the employers' / recruiters' decisions and the anonymous job application policy measure in the second phase of the job assignment process are isolated. Important to note is that isolating those effects results in substantial statistical uncertainty in the analysis as a consequence of the reasonably small number of observations.

The results shown in section 7.2 are again based on linear probability models. Checking the outcomes (and their significance) by probit regression models confirms the estimates in both the separate and combined models with the probability to be hired as dependent variable.

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<sup>109</sup> This striking result does not hold in the analysis of the heterogeneous effects on the HBO/WO level, shown by *table A8* and *A10*. The coefficients which indicate a high education are now positive or at least very small on the HBO/WO level, which is the matching education level. The negative effects in the general model indicate that it is important to have completed an education matching to the required education level, a completed education level which is too low or too high has a negative effect on the probability to be hired.

<sup>110</sup> This is especially the case on the MBO level, indicated by *table A7* and *table A9* in the appendix. During the second phase of the job assignment process high educated applicants have a lower probability to be hired on the MBO level. This effect is statistically significant in model 2 and 3 and control group 2. This may indicate that high educated applicants who are invited for an interview, probably due to their high education, often have other characteristics which employers / recruiters make to decide not to hire them. This indicates that being 'over-qualified' decreases an applicant's chances in the second phase of the job assignment process. Model 1 on the MBO level shows a significant negative effect of being low educated.



To prevent correlation between the error terms, which may arise as a consequence of certain employers / recruiters who are for example very discriminatory in their decisions, while others are not, I have applied White Heteroskedasticity-Consistent standard errors in all linear probability models.

Job specific dummies are included to prevent job specific ‘problems’, like large differences in the number of applicants invited for an interview or the number of applicants for a certain job opening. The job specific dummies, the (low) education dummies and the age dummies which are perfect predictors of being hired or not after being invited for an interview, are excluded. Including those observations and dummies would bias the results. Observations with incomplete information are also excluded. As already discussed I have checked the results for heterogeneous effects between the required education levels, no significant heterogeneous effects arise.

### **7.3 Efficiency effects**

In this section I discuss the effects of the anonymous job application policy measure on the efficiency of the application procedures. I do this on the basis of two efficiency indicators of the application procedure. The first is the anonymous job application coefficient in equation (2) with the probability to be hired as the dependent variable and the second is the number of applicants invited for an interview.

#### **7.3.1 The signal of the invited applicants’ productivity in the treatment group parts**

I start with the anonymous job application coefficient in the combined models which are estimated by equation (2) with the probability to be hired, after being invited for an interview, as the dependent variable. *Table 10* shows the concerning coefficients for all four combined models. The two time-fixed models both indicate a negative anonymous job application coefficient, but this effect is not statistically significant. Hypothesis 7 cannot be rejected for both time-fixed models.

I continue with discussing the department-fixed models. For model 3, which represents the first group of departments, the anonymous job application coefficient is again negative, but not statistically significant. There is no evidence to reject hypothesis 7, anonymous job application does not significantly influence the noisiness of the signal of the applicants’ productivity in the first group of departments. In model 4, which is about the second group of departments, the anonymous job application coefficient is statistically significantly ( $p=0.061$ ) negative. This indicates a lower probability to be hired for the job, after being invited for an interview, for the applicants who are in the treatment group part of model 4. For the second

group of departments hypothesis 7 can be rejected, the anonymous job application procedure significantly reduces the efficiency of the application procedure by a noisier signal of the applicants' productivity.

Now I turn again to checking the results for heterogeneous effects. *Table A9* and *A10* show the concerning models. The time-fixed models (model 1 and 2) and the first department-fixed model (model 3) show no statistically significant heterogeneous effects, but the second department-fixed model (model 4) does. The anonymous job application coefficient is statistically significantly ( $p=0.000$ ) negative on the MBO job level, while it is not statistically significantly positive on the HBO/WO job level.<sup>111</sup> So hypothesis 7 can be rejected only for the MBO level.

I conclude that there is some evidence of a lower efficiency of the application procedures, indicated by a noisier signal of the productivity of the invited applicants, because there is significant evidence with respect to the second group of departments (model 4) on the MBO level. However, for the first group of departments and the HBO/WO level jobs in the second group of departments there is no evidence which signals a lower efficiency of the application procedures.

### **7.3.2 The number of interviews**

The next subject of analysis is the number of interviews per job opening, which is also an indicator of efficiency effects arising as a consequence of the anonymous job application policy measure. *Table 2* in the data description section shows significant differences between the fractions of invited applicants. Because the fraction of invited applicants also heavily depends on the total number of applicants for a job this is a biased indicator of the efficiency effects with respect to the number of invited applicants. The anonymous job application coefficients in the linear probability models shown by *table 7* in section 7.1 are also a biased indicators. Those coefficients indicate the change in probability to be invited for a job interview for applicants in the treatment group part of the concerning model, but the job specific dummies have already controlled for differences in the number of invited applicants between the individual hiring procedures.

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<sup>111</sup> This effect is not caused by the measurement errors which arise in the heterogeneous versions of model 4 with the probability to be invited for an interview as the dependent variable, which are discussed in section 7.1. The number of job specific dummies per group is better spread in this sample, as a consequence excluding the job opening specific dummies in the regression models still results in a statistically significant anonymous job application coefficient, in that case the p-value of this coefficient is 0.001.

To test hypothesis 8, I test on statistically significant lower proportions of job openings over the number of invited applicants in the experiment groups with anonymous job application. I have tested for this between the treatment and the control groups in the same experiment, but also inside the same groups of departments. By doing it in the latter way, it is possible to indicate whether the application procedures in the same groups of departments, at which the same employers / recruiters are deciding, change due to the introduction of the anonymous job application policy measure. For this reason the department-fixed comparison is the most important. *Table 11* shows the results. In this table a lower proportion indicates a higher number of interviews, in relation to the number of job openings. Like already mentioned a higher number of job interviews to fill the same number of vacancies denotes a less efficient job application procedure.

I start with analyzing the two groups of the same experiments, in the previous sections represented by the time-fixed models. The proportions within the experiments are very similar, which suggests that there are no differences in the interview policy of employers / recruiters. Formally testing with the assistance of Chi-Square tests confirms this, hypothesis 8 cannot be rejected for both experiment 1 and 2. Employers / recruiters do not invite significantly more applicants in case of an anonymous job application procedure.

I continue with the differences between the same groups of departments, the most important analysis, represented by the department-fixed models in the previous sections. The first group of departments contains treatment group 1 and control group 2. Again the proportions in the treatment group are not statistically significantly smaller, the effect is even reversed, hypothesis 8 cannot be rejected.<sup>112</sup> For the second group of departments (treatment group 2 and control group 1) the proportion of the treatment group is statistically significantly ( $p=0.061$ ) lower than the proportion of the control group, but specified to the required education levels there are no statistically significant differences. Only on the total level of the second group of departments hypothesis 8 can be rejected, due to anonymous job application procedures the number of interviews per job opening is higher, which indicates a lower efficiency of the application procedure. In this group of departments the employers / recruiters changed their ‘invitation policy’ of the application procedure. This is caused by the fact that they receive less information in the first phase of the application process due to the anonymous job application policy measure.

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<sup>112</sup> Testing on statistically significant differences with the alternative hypothesis that the proportions are not equal to each other also does not result in statistically significant differences.

On the WO level there seems to be support for the alternative hypothesis 8, because the proportions are smaller in all the treatment groups of the four combinations of the separate groups, which indicate higher numbers of interviews after the introduction of anonymous job application. This is the case in both experiment 1 and 2, but also in both groups of departments. However, those differences are not statistically significant,<sup>113</sup> hypothesis 8 cannot be rejected on the WO job level.

Important to notice is that the research period in Nijmegen was probably too short, or the number of experiments was too small, to show a change in the behavior of employers. Besides that a ‘learning-effect’ between the first and the second experiment is impossible, because the employers / recruiters who were in the first treatment group are during the second experiment in the control group. As a consequence it is possible that research about a longer period, or a larger number of experiments, shows different results. I conclude that there is weak evidence that anonymous job application is at the cost of the efficiency of the application procedures, in the second group of the departments the number of interviews per job opening is significantly higher, but this effect is not supported on the included job levels.

*Table 11: The fractions of job openings per interview specified to the required education levels*

Required education	Experiment 1		Experiment 2	
	Treatment group 1	Control group 1	Treatment group 2	Control group 2
MBO	0.26	0.25	0.16	0.16
HBO	0.33	0.26	0.20	0.15
WO	0.22	0.29	0.13	0.26
Total	0.27	0.26	0.17 <sup>+</sup>	0.18

*Notes:* Chi-Square tests on equal proportions, the outcomes are checked by Fisher’s Exact test in case of a lower expected count than 5.

Time-fixed analysis of significant differences in proportions: \* Indicates a statistically significant lower proportion in treatment group 1 (2) than in control group 1 (2) at a 10% significance level. \*\* Indicates a statistically significant lower proportion at a 5% level. \*\*\* Indicates a statistically significant lower proportion at a 1% significance level.

Department-fixed analysis of significant differences in proportions: <sup>+</sup> Indicates a statistically significant lower proportion in treatment group 1 (2) than in control group 2 (1) at a 10% significance level. <sup>++</sup> Indicates a statistically significant lower proportion at a 5% level. <sup>+++</sup> Indicates a statistically significant lower proportion at a 1% significance level.

H<sub>0</sub>: the fractions of job openings per interview are equal in the treatment and the control group.

H<sub>a</sub>: the fraction of job openings per interview is lower in the treatment group than in the control group.

<sup>113</sup> Experiment 1: p=0.368, experiment 2 p=0.110, first group of departments p=0.413 and second group of departments p=0.111.

#### 7.4 Signals of over-qualification

In the appendix table *A11* until *A14* show the fractions of native and immigrant applicants for a job opening with a certain required education level. *Table A11* shows for example that 11.4% of the high educated native applicants in treatment group 1 applies for a job on the WO function level.

I start with analyzing the group of direct signals of over-qualification. High educated workers applying for a job on the MBO level is the first and strongest signal. In all four experiment groups the fraction of immigrants is higher than the fraction of native workers, which supports the alternative hypothesis 9. The difference is statistically significant in both groups of experiment two; hypothesis 9 can be only rejected for those two groups.<sup>114</sup> The results for the second, less strong signal, high educated workers applying for a job on the HBO level, are less convincing. The fraction of immigrant applicants is significantly higher than the fraction of native applicants in control group 1, but the other three groups show the opposite effect, in these groups the fraction of immigrant workers applying is lower than the fraction of native workers. Hypothesis 9 can be only rejected for control group 1. The evidence for the third signal, middle educated workers applying for a job on the MBO level is stronger. The fraction of immigrant applicants is higher than the fraction of native applicants in three experiment groups. In two of those groups the difference is statistically significant, which results in the rejection of hypothesis 9.

I continue with the indirect signals of over-qualification, the fractions of workers applying for job openings with a required education level higher than their highest completed level of education. The first signal is represented by a lower fraction of middle educated immigrants applying for a HBO level job. There is reasonably strong evidence in support of this signal, in three groups the fraction of native applicants is higher and this difference is statistically significant in two of those groups, for which hypothesis 9 can be rejected. The second signal, the middle educated workers applying for a WO level job, is a stronger signal than the first one, but the evidence is less reliable as a consequence of the small number of

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<sup>114</sup> Including an interaction term of ‘high education’ and ‘ethnicity’ in model 3 on the MBO level of paragraph 7.1 results in a statistically significant ( $p=0.072$ ) positive effect (+11.4%). This result indicates that employers in model 3 (first group of departments) value high educated immigrant applicants more than high educated native applicants. This confirms the positive discrimination of immigrants on the MBO level in model 3, but it also shows that ‘over-qualified’ immigrants in line with the first signal (high educated applicant, MBO level job) have a significant higher probability to be invited in comparison to ‘over-qualified’ native applicants, in the first group of departments. Including this interaction term in the other linear probability models does not result in significant effects.

observations. In two groups the fraction of native applicants is higher than the fraction of immigrant applicants, but in none of the groups the difference is statistically significant. Hypothesis 9 cannot be rejected. The next signal is the third signal: the low educated workers who apply for jobs on the HBO level. This signal is from the same magnitude as the previous signal, but again the number of observations is small which hampers the reliability. In treatment group 1 the fraction of immigrants is slightly higher. In the other three groups the fraction of native applicants is higher, but not statistically significantly. Hypothesis 9 can be rejected for none of the groups. For the last signal there are no observations in all four experiment groups.

There is significant support for the alternative hypothesis 9 of various signals of over-qualification, which indicates the existence of hidden discrimination in the labor market. The evidence for the strongest signal is convincing, all groups indicate higher fractions of immigrants and in two groups this difference is statistically significant. The evidence for the less strong direct signals is less convincing. For the second signal there is only statistically significant evidence in one group. For the third signal there is significant evidence in two of the four experiment groups. There is evidence for the first indirect signal, which is again in two groups statistically significant. It is not possible to draw a reliable conclusion about the other indirect signals.

The fact that immigrants are more often ‘over-qualified’ indicates that they expect to be discriminated. In this way discrimination plays a ‘hidden’ role, because immigrants expect to have a lower probability to be invited for a job interview or to be hired for a job. By applying for a job on a lower level they expect to increase their chances because they have completed a higher level of education than most other applicants who apply for the same job. In some cases this probably works, but the results in section 7.1 and 7.2 show that being high educated has a negative significant effect on the probability to be invited or hired on the MBO level in both groups of departments, except for the second group of departments during the second phase of the application process all models show statistically significant coefficients.<sup>115</sup> This indicates that completing an education matching to the required level is the most important.<sup>116</sup> The main point in this analysis is that the immigrants base their decision to apply for a ‘lower job’ on their expectation to be discriminated, not on the real situation. Those expectations

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<sup>115</sup> See *table A5* and *table A9* in the appendix for the results.

<sup>116</sup> The positive interaction between the ethnicity coefficient and the high education coefficient, which is discussed in footnote 114, is an exception to this. This result supports the expectation of immigrants to have a higher probability to be invited / hired when applying for a lower job level.

change the behavior of immigrants. This reduces the allocative efficiency in the labor market, because those workers are not employed at their most productive position.<sup>117</sup>

An effective and permanent anonymous job application policy measure changes the expectations of the immigrants. If the discriminated immigrants know they apply for a job for which the first phase of application procedure is ‘anonymous’ they probably expect to have an equal chance to be invited for an interview. As a consequence they no longer apply for jobs at a lower level. In this way anonymous job application eliminates hidden discrimination in the labor market, which improves the allocative efficiency. During the experiments in Nijmegen it is not possible to notice a change in the behavior of immigrant applicants, because the applicants do not know whether they are part of the experiment. Immigrants’ expectations only change if they know they take part in an anonymous job application procedure.

## **8. Conclusion**

I have investigated whether anonymous job application is able to eliminate discrimination in the labor market during the job assignment process. Besides that the effects of anonymous job application on the efficiency of the job application procedure are assessed. To investigate the effectiveness of the anonymous job application policy measure first the existence of discrimination during the job assignment process has to be proved, otherwise anonymous job application would be redundant. Finally, the possibility of hidden discrimination, revealed by ‘over-qualified’ immigrant applicants is investigated. Those applicants may apply for lower level jobs if they expect to be discriminated during the job assignment process.

The results are based on two experiments with the anonymous job application policy measure in Nijmegen, a Dutch city. The dataset includes almost 2,600 applications for 85 job openings, divided over four experiment groups. The results of the analysis between the same groups of departments (department-fixed models) are the most important for the conclusions, because discrimination during the job assignment process is most likely to depend on the hiring policy of a certain department and the employers / recruiters at the concerning department who implement this policy. Therefore I concentrate on those results, which are supported by the other models.

I start with discussing the first phase of the job assignment process. In the first group of departments there is no significant evidence of discrimination in the general model,

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<sup>117</sup> Allocative efficiency refers to a situation in which the possibilities for mutual gains through exchange are fully exploited. If immigrant workers are employed at lower positions than their capabilities allow, the allocative efficiency is reduced. In that case their (possible) marginal productivity is higher than their wage.

immigrants do not have a significant lower probability to be invited for a job interview after sending a letter of application in this group of departments. However, the heterogeneous analysis, in which the job openings are specified to the required education levels, shows a reasonably large non-significant positive effect on the MBO level and a negative significant effect on the HBO/WO level. With respect to the second group of departments there is significant evidence of discrimination in the general model. The heterogeneous analysis shows only significant evidence of discrimination on the MBO job level.

Introducing anonymous job application reduces discrimination under all circumstances, both negative and positive discrimination of immigrants are reduced, whether the evidence of discrimination is significant or not makes no difference. The effect of the anonymous job application policy measure on the immigrants' probability to be invited is not statistically significant in all cases in which immigrants are significantly discriminated. However, in both groups of departments, including the analyses specified to the required job levels, where the job assignment process was significantly discriminatory, the anonymous job application results in non-significant differences in the probability to be invited for native and immigrant applicants. On the basis of those results I conclude that anonymous job application is effective in eliminating discrimination in the first phase of the job assignment process.

I have found no statistically significant evidence of discrimination during the second phase of the job assignment process. This indicates that all applicants have equal chances to be hired, after being invited for a job interview. The fact that discrimination does not arise in the second phase of the job assignment process, including the groups in which the employers / recruiters were not able to discriminate during the first phase, indicates that the discrimination in the first phase of the job application process is only explainable by the theoretical models of statistical discrimination. Only statistical discrimination can 'disappear' between the two phases of the job assignment process. The anonymous job application policy measure does not significantly influence the probability of immigrants to be hired in the second phase of the job assignment process. The second phase of the job assignment process is non-discriminatory, with and without the anonymous job application policy measure. Those results show that the elimination of discrimination during the first phase of the job assignment process results in the elimination of discrimination during the whole job assignment process, because the employers / recruiters do not discriminate during the second phase of the job assignment process. In the experiments the anonymous job application policy measure has eliminated the statistically significantly discriminatory behavior of the employers / recruiters.



I have also investigated whether the introduction of anonymous job application is at the cost of the efficiency of the application procedures. I have assessed this on the basis of two signals: the noisiness of the signal of the applicants' productivity during the application procedure and the number of applicants invited for a job interview. With respect to both signals there is only evidence of a lower efficiency of the application procedure in the second group of departments. The evidence of a noisier signal of the applicants' productivity arises in the second group of departments, but is completely caused by a loss in efficiency on the MBO level. The number of interviews is significantly higher in the treatment group of the general analysis of the second group of departments, but this effect is not supported by significant differences on the different job levels. The evidence of a lower efficiency of the application procedure is reasonably weak.

The analysis of the possibility of more 'over-qualified' immigrant applicants, which indicates 'hidden discrimination', shows that there is reasonable strong evidence that immigrants workers on average are more often 'over-qualified' for the jobs they apply for than native workers. This shows that the introduction of a permanent anonymous job application policy measure results in much larger effects of anonymous job application. In that case immigrants adapt their expectations. As a consequence 'hidden discrimination' is reduced, which is at the benefit of the (allocative) efficiency.

I conclude that anonymous job application is able to eliminate discrimination during the job assignment process, after the introduction of the anonymous job application policy measure immigrants do not have an unequal probability to be invited for an interview and to be hired. The anonymous job application policy measure enforces a color-blind hiring policy. In the short term there is only weak evidence of a reduced efficiency of the application procedure and the evidence of 'hidden discrimination' shows that the effects of anonymous job application are probably even larger in the long term.

The question whether the anonymous job application policy measure should be recommended to introduce permanently and nationwide is difficult to answer, but the most important requirement is fulfilled, the empirical analysis proves the effectiveness of the anonymous job application policy measure in eliminating discrimination; it enforces a color-blind hiring policy of employers / recruiters. The empirical results also indicate that 'hidden discrimination' occurs during the job assignment process. The fact that this form of discrimination depends on the expectations of immigrants probably increases the effects of a permanent anonymous job application policy measure. However, long term effects on the

efficiency of the application process are not assessed. Probably, in the long term the efficiency of the application process will be reduced, which may be an important disadvantage of anonymous job application procedures if it for example increases the number of misassignments. Further research is needed to assess both the long term effects of anonymous job application on 'hidden discrimination' and the efficiency of the application procedures. Another point is represented by the diversity policies, employers / recruiters who want to increase the representation of immigrants are no longer able to put this into practice. As a consequence in a labor market with a strong history of discrimination anonymous job application results only in the (very) long term in a proportionally equal division of native and immigrant workers, despite the fact that anonymous job application directly enforces a color-blind hiring policy. Finally, the attitude of the employers / recruiters may cause problems. They do not admit the existence of discrimination during the job assignment process and negate that anonymous job application increases the probability of immigrants to be invited for an interview or to be hired. Besides that they indicate that they do not like the anonymous job application procedures, they experience those procedures as difficult, especially in case of several application procedures alongside. As an example they mention the communication about 'numbered applicants',<sup>118</sup> which may be confusing and increases the probability of mistakes (Gemeente Nijmegen, 2008).

Those problems and drawbacks have to be weighed against the benefits of eliminating discrimination during the job assignment process. Those are all the benefits which arise from equal opportunities for all applicants during the job assignment process.

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<sup>118</sup> Instead of by their names, which are concealed from the employers / recruiters in case of an 'anonymous application procedure', the applicants are registered on the basis of an arbitrary number.

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## 10. Appendix

Table A1: Description of applicants specified to native and immigrant groups

	Experiment 1				Experiment 2			
	Treatment group 1		Control group 1		Treatment group 2		Control group 2	
	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants
Invited for interview	0.096	0.088	0.155*	0.087	0.226	0.208	0.177	0.162
Hired	0.030	0.029	0.072	0.038	0.049	0.050	0.038	0.043
Female	0.592*	0.686	0.542***	0.692	0.559***	0.742	0.485**	0.590
Sex unknown	0.000	0.000	0.000	0.000	0.002	0.008	0.000	0.000
Age	39.84***	34.66	39.10***	33.04	-	-	-	-
<30	0.200***	0.353	0.194***	0.394	0.201*	0.283	0.194***	0.359
30-45	0.396	0.422	0.488	0.481	0.413	0.442	0.446	0.453
45-65	0.378***	0.196	0.294***	0.096	0.356***	0.192	0.340***	0.162
Unknown	0.026	0.029	0.024	0.029	0.030	0.083	0.017	0.004
Education level								
Low	0.132	0.078	0.063	0.077	0.022	0.017	0.142	0.103
Middle	0.548*	0.637	0.373*	0.462	0.404***	0.558	0.329***	0.504
High	0.319	0.284	0.546***	0.404	0.563***	0.408	0.502***	0.333
Unknown	0.018	0.000	0.018	0.057	0.012	0.017	0.027*	0.060
# observations	561	102	424	98	507	119	639	117

Notes: Chi-Square tests on equal proportions, checked by Fisher's Exacts test in case of small numbers of observations. For the age in experiment 1 a two-sample t-significance test is applied.

\* Indicates a statistically significant difference at a 10% significance level between the proportions of native and immigrant applicants in a certain group.

\*\* Indicates a statistically significant difference at a 5% significance level between the proportions of native and immigrant applicants in a certain group.

\*\*\* Indicates a statistically significant difference at a 1% significance level between the proportions of native and immigrant applicants in a certain group.

Table A2: Description of applicants invited for an interview specified to native and immigrant groups

	Experiment 1				Experiment 2			
	Treatment group 1		Control group 1		Treatment group 2		Control group 2	
	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants	Native applicants	Immigrant applicants
Hired	0.315	0.303	0.471	0.444	0.217	0.240	0.212	0.263
Female	0.630	0.444	0.559	0.667	0.513***	0.800	0.469	0.632
Age	37.240	34.330	37.350	34.780	-	-	-	-
<30	0.167*	0.444	0.206	0.333	0.191	0.200	0.150*	0.316
30-45	0.648	0.444	0.529	0.556	0.548	0.444	0.619	0.526
45-65	0.185	0.111	0.250	0.111	0.200	0.320	0.195	0.105
unknown	0.000	0.001	0.015	0.000	0.061	0.040	0.035	0.053
Education level								
Low	0.074	0.000	0.044	0.000	0.026	0.000	0.106	0.105
Middle	0.574	0.556	0.368	0.333	0.357*	0.560	0.310*	0.526
High	0.352	0.444	0.574	0.556	0.609	0.440	0.575*	0.368
Unknown	0.000	0.000	0.015	0.111	0.009	0.000	0.090	0.000
# observations	54	9	68	9	115	25	113	19

Notes: Chi-Square tests on equal proportions, checked by Fisher's Exacts test in case of small numbers of observations. For the age in experiment 1 a two-sample t-significance test is applied.

\* Indicates a statistically significant difference at a 10% significance level between the proportions of native and immigrant applicants in a certain group.

\*\* Indicates a statistically significant difference at a 5% significance level between the proportions of native and immigrant applicants in a certain group.

\*\*\* Indicates a statistically significant difference at a 1% significance level between the proportions of native and immigrant applicants in a certain group.

*Table A3: Linear probability estimates of being invited for a job interview for MBO level jobs separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	-0.029 (0.033)	-0.076** (0.033)	-0.010 (0.067)	0.079* (0.048)
Sex	0.025 (0.030)	0.041 (0.040)	-0.104 (0.075)	0.048 (0.038)
Age: younger than 30	-0.016 (0.031)	-0.029 (0.041)	-0.047 (0.072)	-0.092** (0.045)
Age: older than 45	-0.061* (0.033)	-0.015 (0.044)	-0.157*** (0.060)	-0.075* (0.042)
Low educated	-0.015 (0.031)	-0.066 (0.050)	0.057 (0.136)	-0.061 (0.046)
High educated	-0.018 (0.029)	-0.075** (0.037)	-0.069 (0.066)	-0.088** (0.042)
# Observations	472	344	225	401
R-squared	0.0707	0.1229	0.1233	0.1094

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

*Table A4: Linear probability estimates of being invited for a job interview for HBO/WO level jobs separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	-0.021 (0.097)	-0.134 (0.184)	0.011 (0.056)	-0.163** (0.076)
Sex	-0.005 (0.067)	0.141** (0.067)	0.066 (0.045)	0.019 (0.055)
Age: younger than 30	-0.209* (0.114)	-0.008 (0.076)	-0.109** (0.055)	-0.097 (0.061)
Age: older than 45	-0.148*** (0.055)	-0.003 (0.070)	-0.126*** (0.046)	-0.184*** (0.046)
Low educated	-	-	0.119 (0.093)	-
High educated	-0.030 (0.047)	0.195** (0.080)	-0.021 (0.050)	0.156*** (0.056)
# Observations	171	177	383	325
R-squared	0.1771	0.1763	0.1775	0.1312

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown. There are no dummy variables included for applicants with a low education in the linear probability models for treatment group 1, control group 1 and control group 2 because being low educated perfectly predicts a negative outcome in the concerning models.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

Table A5: Linear probability estimates of being invited for a job interview for MBO level jobs combined models

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	-0.080** (0.033)	0.073 (0.047)	0.073 (0.047)	-0.077** (0.034)
Anonymous job application	0.383 (0.354)	0.028 (0.102)	0.195 (0.349)	0.192** (0.088)
Anonymous job application * Ethnicity	0.051 (0.046)	-0.060 (0.080)	-0.103* (0.057)	0.097 (0.072)
Sex	0.033 (0.024)	0.002 (0.035)	0.034 (0.024)	-0.005 (0.036)
Age: younger than 30	-0.020 (0.025)	-0.073* (0.039)	-0.048* (0.026)	-0.035 (0.038)
Age: older than 45	-0.040 (0.027)	-0.098*** (0.035)	-0.065** (0.026)	-0.067* (0.036)
Low educated	-0.038 (0.027)	-0.034 (0.043)	-0.035 (0.028)	-0.039 (0.051)
High educated	-0.046** (0.023)	-0.077** (0.035)	-0.049* (0.025)	-0.072** (0.033)
# Observations	816	626	873	569
R-squared	0.0970	0.1093	0.1005	0.1220
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.375	0.834	0.368	0.759
Discriminatory without AJA	Yes	No	No	Yes
Discriminatory with AJA	No	No	No	No

Notes: Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity\*anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution. In case of a smaller sample this is checked by the F-distribution.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a significance 5% level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

*Table A6: Linear probability estimates of being invited for a job interview for HBO/WO level jobs combined models*

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	-0.129 (0.083)	-0.178** (0.077)	-0.180** (0.076)	-0.128 (0.082)
Anonymous job application	-0.121 (0.146)	-0.103 (0.160)	0.021 (0.108)	-0.359*** (0.113)
Anonymous job application * Ethnicity	0.082 (0.127)	0.195** (0.095)	0.123 (0.119)	0.137 (0.099)
Sex	0.073 (0.048)	0.048 (0.035)	0.012 (0.043)	0.090** (0.038)
Age: younger than 30	-0.058 (0.064)	-0.109*** (0.041)	-0.118** (0.054)	-0.070 (0.045)
Age: older than 45	-0.087** (0.044)	-0.149*** (0.033)	-0.168*** (0.036)	-0.088** (0.039)
Low educated	-	-0.054 (0.070)	-	0.010 (0.161)
High educated	0.016 (0.041)	0.047 (0.038)	0.059 (0.037)	0.013 (0.044)
# Observations	348	714	512	571
R-squared	0.1553	0.1524	0.1425	0.1712
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.628	0.760	0.543	0.870
Discriminatory without AJA	No	Yes	Yes	No
Discriminatory with AJA	No	No	No	No

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is invited for a job interview. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity\*anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution. In case of a smaller sample this is checked by the F-distribution. There are no dummy variables included for applicants with a low education in models 1 and 3, because being low educated perfectly predicts a negative outcome in the concerning models.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

*Table A7: Linear probability estimates of being hired for MBO level jobs separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	0.170 (0.309)	0.150 (0.395)	0.207 (0.169)	-0.012 (0.137)
Sex	0.173 (0.362)	0.254 (0.301)	0.111 (0.247)	0.240 (0.153)
Age: younger than 30	-0.151 (0.273)	0.025 (0.296)	-0.073 (0.191)	-0.070 (0.175)
Age: older than 45	0.338 (0.380)	-0.020 (0.292)	-0.189 (0.198)	0.112 (0.157)
Low educated	-0.613 (0.372)	-0.487 (0.482)	-	-0.171 (0.173)
High educated	-0.139 (0.345)	-0.389 (0.248)	-0.071 (0.236)	-0.292** (0.121)
# Observations	37	32	43	60
R-squared	0.1345	0.2592	0.1374	0.1495

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. There is no dummy variable included for applicants with a low education in the linear probability model of treatment group 2, because being low educated perfectly predicts a negative outcome in this model.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

*Table A8: Linear probability estimates of being hired for HBO/WO level jobs separate groups*

	Treatment group 1	Control group 1	Treatment group 2	Control group 2
Ethnicity	-0.190 (0.534)	-0.010 (0.283)	0.036 (0.178)	0.154 (0.481)
Sex	-0.464* (0.248)	-0.308 (0.259)	0.94 (0.103)	0.019 (0.177)
Age: younger than 30	0.288 (0.642)	0.576 (0.262)	0.165** (0.181)	-0.112 (0.224)
Age: older than 45	-	-0.315 (0.261)	-0.253 (0.110)	0.087 (0.223)
Low educated	-	-	-	-
High educated	0.372 (0.356)	-	-0.017 (0.153)	-0.112 (0.253)
# Observations	23	32	86	63
R-squared	0.2305	0.2224	0.1874	0.0556

*Notes:* Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. There are no dummy variables included for applicants with a low education in the linear probability models for all four experiment groups, because being low educated perfectly predicts a negative outcome in the concerning models. For treatment group 1 there is no dummy variable for old applicants included, because this is also a perfect predictor. For control group 1 the same applies for the high educated dummy.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.



Table A9: Linear probability estimates of being hired for MBO level jobs combined models

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	0.251 (0.323)	-0.051 (0.123)	-0.009 (0.129)	0.021 (0.216)
Anonymous job application	-0.018 (0.351)	-0.025 (0.257)	0.120 (0.291)	-0.670*** (0.152)
Anonymous job application * Ethnicity	-0.044 (0.423)	0.248 (0.224)	0.244 (0.275)	0.163 (0.272)
Sex	0.205 (0.206)	0.221* (0.119)	0.211* (0.137)	0.156 (0.130)
Age: younger than 30	-0.083 (0.172)	-0.042 (0.110)	-0.091 (0.130)	-0.027 (0.130)
Age: older than 45	0.129 (0.211)	0.014 (0.111)	0.122 (0.138)	-0.088 (0.122)
Low educated	-0.464** (0.230)	-0.145 (0.140)	-0.225 (0.149)	-0.170 (0.174)
High educated	-0.235 (0.202)	-0.214** (0.107)	-0.236* (0.141)	-0.179 (0.132)
# Observations	69	105	97	86
R-squared	0.2071	0.1286	0.1342	0.3450
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.417	0.266	0.329	0.276
Discriminatory without AJA	No	No	No	No
Discriminatory with AJA	No	No	No	No

Notes: Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity\*anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution. In case of a smaller sample this is checked by the F-distribution.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

Table A10: Linear probability estimates of being hired for HBO/WO level jobs combined models

	Time-fixed models		Department-fixed models	
	Model 1 T1-C1	Model 2 T2-C2	Model 3 T1-C2	Model 4 T2-C1
Ethnicity	0.063 (0.292)	0.218 (0.448)	0.190 (0.537)	0.042 (0.280)
Anonymous job application	0.043 (0.560)	0.340 (0.338)	0.067 (0.424)	0.369 (0.327)
Anonymous job application * Ethnicity	-0.480 (0.538)	-0.171 (0.484)	-0.267 (0.675)	-0.000 (0.335)
Sex	-0.377*** (0.132)	0.067 (0.092)	-0.095 (0.147)	0.052 (0.092)
Age: younger than 30	0.633*** (0.210)	0.066 (0.146)	-0.008 (0.223)	0.285** (0.144)
Age: older than 45	-0.477*** (0.116)	-0.189* (0.098)	-0.165 (0.163)	-0.256** (0.093)
Low educated	-	-	-	-
High educated	0.211 (0.349)	-0.015 (0.128)	0.097 (0.208)	-0.022 (0.62)
# Observations	54	149	86	117
R-squared	0.3625	0.1070	0.0746	0.2003
P-value test: $H_0: \beta^{\text{ethn}} + \beta^{\text{effect}} = 0$ $H_a: \beta^{\text{ethn}} + \beta^{\text{effect}} \neq 0$	0.350	0.775	0.848	0.819
Discriminatory without AJA	No	No	No	No
Discriminatory with AJA	No	No	No	No

Notes: Estimates from the linear probability model, robust (White Heteroskedasticity-Consistent) standard errors in parentheses. The dependent variable is equal to 1 if the applicant is hired for the job. The constant factor and the dummy coefficients for the job specific effects are not shown. The test on the sum of the ethnicity and ethnicity\*anonymous job application coefficients is a Wald test, which is based on the Chi-Square distribution. In case of a smaller sample this is checked by the F-distribution. There are no dummy variables included for applicants with a low education in all four models, because being low educated perfectly predicts a negative outcome in the concerning models.

\* Indicates a statistically significant coefficient at a 10% significance level.

\*\* Indicates a statistically significant coefficient at a 5% significance level.

\*\*\* Indicates a statistically significant coefficient at a 1% significance level.

*Table A11: Treatment group 1: Fraction of native / immigrant applicants for a job opening with a certain required education level*

Education level applicants	Ethnicity applicants	Required education level job opening		
		WO	HBO	MBO
High	Native	0,114	0,426	0,460
	Immigrant	0,172	0,310	0,517
	Total	0,122	0,410	0,468
Middle	Native	0,010	0,182 <sup>+++</sup>	0,808
	Immigrant	0,015	0,046	0,938 <sup>***</sup>
	Total	0,011	0,158	0,831
Low	Native	0,000	0,123	0,877
	Immigrant	0,000	0,125	0,875
	Total	0,000	0,123	0,877
Unknown	Native	0,000	0,300	0,700
	Immigrant	0,000	0,000	0,000
	total	0,000	0,300	0,700
Total		0,044	0,234	0,722

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exact Test in case of small numbers of observations. Only the fractions which show the signals described in the main text are tested on statistically significant differences.

*Direct signals of over-qualification:* indicate a statistically significant higher fraction of immigrant applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

\* Indicates a statistically significant difference at a 10% significance level.

\*\* Indicates a statistically significant difference at a 5% significance level.

\*\*\* Indicates a statistically significant difference at a 1% significance level.

H<sub>0</sub>: the fractions of native and immigrant applicants are equal.

H<sub>a</sub>: the fraction of immigrant applicants is higher than the fraction of native applicants.

*Indirect signals of over-qualification:* indicate a statistically significant larger fraction of native applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

<sup>+</sup> Indicates a statistically significant difference at a 10% significance level.

<sup>++</sup> Indicates a statistically significant difference at a 5% significance level.

<sup>+++</sup> Indicates a statistically significant difference at a 1% significance level.

H<sub>0</sub>: the fractions of native and immigrant applicants are equal.

H<sub>a</sub>: the fraction of immigrant applicants is lower than the fraction of native applicants.

*Table A12: Control group 1: Fraction of native / immigrant applicants for a job opening with a certain required education level*

Education level applicants	Ethnicity applicants	Required education level job opening		
		WO	HBO	MBO
High	Native	0,371	0,215	0,414
	Immigrant	0,214	0,310*	0,476
	Total	0,348	0,229	0,423
Middle	Native	0,012	0,075 <sup>+</sup>	0,913
	Immigrant	0,021	0,021	0,958
	Total	0,014	0,062	0,923
Low	Native	0,000	0,037	0,963
	Immigrant	0,000	0,000	1,000
	Total	0,000	0,029	0,971
Unknown	Native	0,125	0,125	0,750
	Immigrant	0,000	0,167	0,833
	total	0,071	0,143	0,786
Total		0,188	0,149	0,663

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exact Test in case of small numbers of observations. Only the fractions which show the signals described in the main text are tested on statistically significant differences.

*Direct signals of over-qualification:* indicate a statistically significant higher fraction of immigrant applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

\* Indicates a statistically significant difference at a 10% significance level.

\*\* Indicates a statistically significant difference at a 5% significance level.

\*\*\* Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is higher than the fraction of native applicants.

*Indirect signals of over-qualification:* indicate a statistically significant larger fraction of native applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

<sup>+</sup> Indicates a statistically significant difference at a 10% significance level.

<sup>++</sup> Indicates a statistically significant difference at a 5% significance level.

<sup>+++</sup> Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is lower than the fraction of native applicants.

*Table A13: Treatment group 2: Fraction of native / immigrant applicants for a job opening with a certain required education level*

Education level applicants	Ethnicity applicants	Required education level job opening		
		WO	HBO	MBO
High	Native	0,227	0,646	0,127
	Immigrant	0,200	0,600	0,200*
	Total	0,223	0,639	0,138
Middle	Native	0,024	0,311	0,665
	Immigrant	0,000	0,441	0,559
	Total	0,018	0,343	0,639
Low	Native	0,000	0,182	0,818
	Immigrant	0,000	0,000	1,000
	Total	0,000	0,143	0,857
Unknown	Native	0,000	0,667	0,333
	Immigrant	0,000	0,500	0,500
	total	0,000	0,625	0,375
Total		0,127	0,501	0,372

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exact Test in case of small numbers of observations. Only the fractions which show the signals described in the main text are tested on statistically significant differences.

*Direct signals of over-qualification:* indicate a statistically significant higher fraction of immigrant applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

\* Indicates a statistically significant difference at a 10% significance level.

\*\* Indicates a statistically significant difference at a 5% significance level.

\*\*\* Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is higher than the fraction of native applicants.

*Indirect signals of over-qualification:* indicate a statistically significant larger fraction of native applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

+ Indicates a statistically significant difference at a 10% significance level.

++ Indicates a statistically significant difference at a 5% significance level.

+++ Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is lower than the fraction of native applicants.

*Table A14: Control group 2: Fraction of native / immigrant applicants for a job opening with a certain required education level*

Education level applicants	Ethnicity applicants	Required education level job opening		
		WO	HBO	MBO
High	Native	0,458	0,346	0,196
	Immigrant	0,154	0,179	0,667***
	Total	0,425	0,328	0,247
Middle	Native	0,062	0,162	0,776
	Immigrant	0,017	0,102	0,881**
	Total	0,052	0,149	0,799
Low	Native	0,022	0,044	0,934
	Immigrant	0,000	0,000	1,000
	Total	0,019	0,039	0,942
Unknown	Native	0,176	0,059	0,765
	Immigrant	0,000	0,000	1,000
	total	0,125	0,042	0,833
Total		0,228	0,216	0,557

*Notes:* Chi-Square tests on equal proportions, checked by Fisher's Exact Test in case of small numbers of observations. Only the fractions which show the signals described in the main text are tested on statistically significant differences.

*Direct signals of over-qualification:* indicate a statistically significant higher fraction of immigrant applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

\* Indicates a statistically significant difference at a 10% significance level.

\*\* Indicates a statistically significant difference at a 5% significance level.

\*\*\* Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is higher than the fraction of native applicants.

*Indirect signals of over-qualification:* indicate a statistically significant larger fraction of native applicants with a certain completed education level (high / middle / low) applying for job openings with a certain required education level (WO / HBO / MBO).

<sup>+</sup> Indicates a statistically significant difference at a 10% significance level.

<sup>++</sup> Indicates a statistically significant difference at a 5% significance level.

<sup>+++</sup> Indicates a statistically significant difference at a 1% significance level.

$H_0$ : the fractions of native and immigrant applicants are equal.

$H_a$ : the fraction of immigrant applicants is lower than the fraction of native applicants.