# Ethnic Discrimination in Hiring Decisions – Supplementary Material

Didier Ruedin & Eva Zschirnt

15 December 2015

This is the supplementary material for 'Ethnic Discrimination in Hiring Decisions: A Meta-Analysis of Correspondence Tests 1990–2015'.

## S1. List of Studies

By year of publication

| Author(s) | Year | Country |
|---|---|---|
| Bendick et al. | 1991 | US |
| Riach & Rich | 1991 | Australia |
| Esmail & Everington | 1993 | UK |
| Goldberg et al. | 1994 | Germany |
| Bovenkerk et al. | 1995 | Netherlands |
| De Prada et al. | 1995 | Spain |
| Esmail & Everington | 1997 | UK |
| Arijn et al. | 1998 | Belgium |
| Lodder et al. | 2003 | US |
| Fibbi et al. | 2003 | Switzerland |
| Bertrand & Mullainathan | 2004 | US |
| Allasino et al. | 2006 | Italy |
| Cédiey & Foroni | 2007 | France |
| Attström | 2007 | Sweden |
| Bursell | 2007 | Sweden |
| Carlsson & Rooth | 2007 | Sweden |
| Wood et al. | 2009 | UK |
| Carlsson | 2010 | Sweden |
| Duguet et al. | 2010 | France |
| Drydakis & Vlassis | 2010 | Greece |
| Akintola | 2011 | Sweden |

| Author(s) | Year | Country |
|---|---|---|
| Akintola | 2011 | Canada |
| McGinnity & Lunn | 2011 | Ireland |
| Oreopoulos | 2011 | Canada |
| Widner & Chicoine | 2011 | US |
| Eid | 2012 | Canada |
| Arai et al. | 2012 | Sweden |
| Booth et al. | 2012 | Australia |
| Dechief & Oreopoulos | 2012 | Canada |
| Drydakis | 2012 | Greece |
| Jacquement & Yannelis | 2012 | US |
| Kaas & Manger | 2012 | Germany |
| Andriessen et al. | 2012 | Netherlands |
| Arceo-Gomes & Campos-Yasquez | 2013 | Mexico |
| Baert et al. | 2013 | Belgium |
| Gaddis | 2014 | US |
| Nunley et al. | 2014 | US |
| Schneider et al. | 2014 | Germany |
| Midtbøen | 2014 | Norway |
| Wysienska-Di Carlo & Karpinski | 2014 | Poland |
| Decker et al. | 2015 | US |
| Weichselbauer | 2015 | Austria |
| Weichselbauer | 2015 | Germany |

## S2. Explanatory Variables

This is a table of the explanatory variables and how they were operationalized in the article.

| Variable | Description |
|---|---|
| Generation | First-generation immigrants are born abroad; second-generation immigrants are born in the country. There are two variables, one capturing generation as explicitly stated in the original, and one where implicit information was considered (e.g. education completed in the country of destination). |
| Specific Groups | The following groups are differentiated: Arabs and people of Middle Eastern origin [Arab, Middle Eastern origin, foreign name (Arabic or horn of Africa region)]; Chinese [Chinese, Chinese with English first name]; Indians, Pakistani, and Bangladeshi [Indian, Pakistani, Pakistani/Bangladeshi]; and Turks. |

| Variable | Description |
|---|---|
| Economic: GDP Growth | Annual GDP growth rates were taken from the World Bank (2015). We created a new binary variable for high or low GDP growth: higher or lower than the mean values in the studies covered. |
| Economic: Unemployment | Annual unemployment rates were taken from the World Bank (2015). We created a new binary variable for high or low unemployment: higher or lower than the mean values in the studies covered. |
| Applicant Sex | Male, female |
| Private/Public | Private, public sector |
| European Directives | European Union Directive 2000/43/EC on the principle of equal treatment between persons irrespective of racial or ethnic origin, commonly known as the "Race Directive", and the Employment Equality Framework Directive 2000/78/EC, see section S3 for the coding of the implementation dates. |
| Region | North America: Canada, United States; Europe: Austria, Belgium, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, United Kingdom; Other OECD: Mexico, Australia |
| German-speaking country | Austria, Germany, Switzerland |

# S3. Pre/post 2000 Directives

## National Implementation of Directives

The following years were taken as the implementation years (transposition date) of the directives at the national level. In case of multiple legal changes, the most significant change was identified. By design, the directives only concern EU member states.

| Country | Transposition Date |
|---|---|
| Austria | 2004/2005 |
| Belgium | 2003 |
| France | 2001 |
| Germany | 2006 |
| Greece | 2005 |
| Ireland | 2004 |
| Italy | 2003 |

| Country | Transposition Date |
|---|---|
| Netherlands | 2004 |
| Poland | 2010 |
| Spain | 2003 |
| Sweden | 2003 |
| UK | 2003/2004 |

## S4. Measures of Discrimination

Three measures of discrimination are common: relative call-back rates, net discrimination rates, and odds ratios. They are calculated as follows:

Relative call-back rate: $\text{success}_{\text{majority}}$ / $\text{success}_{\text{minority}}$, where $\text{success}_{\text{majority}} = (\text{N}_{\text{both invited}} + \text{N}_{\text{only majority invited}})$ / $\text{N}_{\text{one or more success}}$

Net discrimination rate: $\text{success}_{\text{majority}} - \text{success}_{\text{minority}} = (\text{N}_{\text{only majority invited}} - \text{N}_{\text{only minority invited}})$ / $\text{N}_{\text{one or more success}}$

Odds ratios are calculated on the basis of: number of applications by minority without response (failure), number of application by minority with response (success), number of applications by majority without response (failure), number of applications by majority with response (success). Majority applicants constitute the control group, while minority applicants are considered the treatment group.

## S5. Relative Call-Back Rate over Time

This table shows the relative call-back rates for five periods.

| | 1990–1995 | 1996–2000 | 2001–2005 | 2006–2010 | 2011–2015 |
|---|---|---|---|---|---|
| Study level | 1.29 | 1.50 | 1.47 | 1.98 | 1.47 |
| Subgroup level | 1.28 | 2.04 | 1.54 | 2.28 | 1.60 |

## S6. General Summary

The following two sections present random-effects models to summarize research at the study level and at the subgroup level.

### Study Level

Random-effects model with REML as $\text{tau}^2$ estimator.

| Estimate | SE | p-value |
|---|---|---|
| -0.509 | 0.070 | <.0001 |

AICc = 41.5

| | |
|---|---|
| $tau^2$ (estimated amount of total heterogeneity) | 0.141 (SE = 0.040) |
| tau (square root of estimated $tau^2$ value) | 0.375 |
| $I^2$ (total heterogeneity / total variability) | 92.7% |
| $H^2$ (total variability / sampling variability) | 13.8 |
| Test for Heterogeneity: Q(df = 33) = 327.7 | p < .0001 |

## Subgroups

Random-effects model with REML as $tau^2$ estimator.

| Estimate | SE | p-value |
|---|---|---|
| -0.6041 | 0.0283 | <.0001 |

AICc = 254.9

| | |
|---|---|
| $tau^2$ (estimated amount of total heterogeneity) | 0.093 (SE = 0.0154) |
| tau (square root of estimated $tau^2$ value) | 0.306 |
| $I^2$ (total heterogeneity / total variability) | 68.2% |
| $H^2$ (total variability / sampling variability) | 3.15 |
| Test for Heterogeneity: Q(df = 214) = 647.3077 | p < .0001 |

## Summary of Models and Call-Back Rates

Given are the odds ratios from the models in the previous sections.

| | Odds Ratio |
|---|---|
| Study | 0.509 |
| Subgroup | 0.604 |

Given are the call-back rates (mean and median) for the study and subgroup level.

| | Mean | Median |
|---|---|---|
| Study | 1.55 | 1.44 |
| Subgroup | 1.75 | 1.49 |

## S7. First and Second Generation: Odds Ratios

Given are the odds ratios from random-effects models (like in section S6).

| | Odds Ratios |
|---|---|
| First generation | 0.587 |
| Second generation | 0.521 |
| Second generation (explicit only) | 0.551 |

## S8. Specific Groups: Odds Ratios

Given are the odds ratios from random-effects models (like in section S6).

| | Odds Ratios |
|---|---|
| Arabs and people of Middle Eastern origin | 0.383 |
| Chinese | 0.633 |
| Indians, Pakistani, and Bangladeshi | 0.593 |
| Turkish | 0.779 |

## S9. Europe versus US/Canada

Given are the call-back rates (mean, median) and the odds ratios from random-effects models (like in section S6).

| | Mean | Median | Odds Ratios |
|---|---|---|---|
| Europe | 1.84 | 1.52 | 0.542 |
| US/Canada | 1.69 | 1.49 | 0.563 |

## S10. German-Speaking Countries: Odds Ratios

Given are the odds ratios from random-effects models (like in section S6).

| | Odds Ratios |
|---|---|
| Other countries | 0.505 |
| German-speaking countries | 0.716 |

# S11. Economic Situation

There are two variable to match the economic situation: the time of testing as indicated in the study, and one that *additionally* assumes that the time of testing was one year before publication for the studies that do not indicate the time of testing (implicit dates). Both methods are compared.

## Unemployment

Given are the call-back rates (mean, median) for situations of low unemployment and high unemployment. Spain is an outlier with an unemployment rate greater than 20 per cent. It is excluded in the last two lines of the table.

| | Low Unemployment | High Unemployment |
|---|---|---|
| Mean | 1.68 | 2.03 |
| Median | 1.50 | 1.44 |
| Mean (including implicit dates) | 1.85 | 1.94 |
| Median (including implicit dates) | 1.60 | 1.45 |
| Mean (excluding Spain) | 1.68 | 2.19 |
| Median (excluding Spain) | 1.50 | 1.52 |

Pearson's product-moment correlation between unemployment rate and call-back rate: r = -0.0458, p = 0.5

## Annual GDP Growth

Given are the call-back rates (mean, median) for situations of low GDP growth and high GDP growth.

| | Low GDP Growth | High GDP Growth |
|---|---|---|
| Mean | 1.67 | 1.90 |
| Median | 1.54 | 1.43 |
| Mean (including implicit dates) | 1.64 | 2.06 |
| Median (including implicit dates) | 1.51 | 1.68 |

Pearson's product-moment correlation between GDP growth and call-back rate: r = 0.0412, p = 0.5

## S12. Publication Bias

Using a meta-analysis, it is also possible to enumerate the estimated publication bias. The follwing figures are so-called funnel plots, indicating as black dots the estimates for each of the studies, and as white dots the studies that are needed to obtain a balanced picture. The presence of white dots in the figures indicates that conventional tests of publication bias indicate clearly that publication bias is likely, with some studies finding less discrimination or no discrimination 'missing'. While publication bias is usually linked to the non-publication of studies failing to produce 'statistically significant' results, we are puzzled about this particular finding. Given that studies report discrimination against minority groups rather consistently, we suspect that a study finding no difference between the minority and majority population, or even one that indicates positive discrimination in favour of the minority groups would actually be *easier* to publish.

The first figure and the analysis just below give the situation at the study level (Figure 1). The study by Bendick et al. (1991) was excluded, as it may unduly affect considerations of publication bias. With the study by Bendick et al. in the model, the number of 'missing' studies on the right side is 8.

Random-effects model with REML as $tau^2$ estimator.

Estimated number of missing studies on the right side: 5 (SE = 3.8)

| Estimate | SE | p-value |
|---|---|---|
| -0.4779 | 0.0606 | <.0001 |

AICc = 43.6

| | |
|---|---|
| $tau^2$ (estimated amount of total heterogeneity) | 0.108 (SE = 0.031) |
| tau (square root of estimated $tau^2$ value) | 0.328 |
| $I^2$ (total heterogeneity / total variability) | 89.8% |
| $H^2$ (total variability / sampling variability) | 9.8 |
| Test for Heterogeneity: Q(df = 37) = 276.2 | p < .0001 |

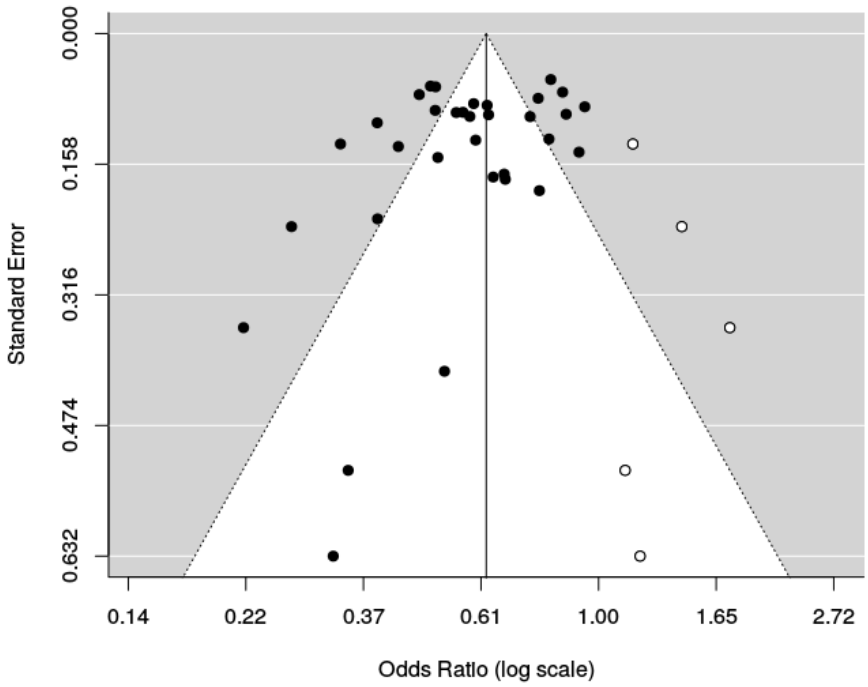


Figure 1: Funnel Plot for Study Level

The second figure and the analysis just below give the situation at the subgroup level (Figure 2). In order to make the figure legible, the five studies with the largest standard error (>0.8) were removed from the figure, but they are included in the analysis.

Random-effects model with REML as $tau^2$ estimator.

Estimated number of missing studies on the right side: 22 (SE = 9.4)

| Estimate | SE | p-value |
|---|---|---|
| -0.5343 | 0.0315 | <.0001 |

AICc = 360.2

| | |
|---|---|
| $tau^2$ (estimated amount of total heterogeneity) | 0.144 (SE = 0.020) |
| tau (square root of estimated $tau^2$ value) | 0.380 |
| $I^2$ (total heterogeneity / total variability) | 75.8% |
| $H^2$ (total variability / sampling variability) | 4.1 |
| Test for Heterogeneity: Q(df = 236) = 848.9 | p < .0001 |

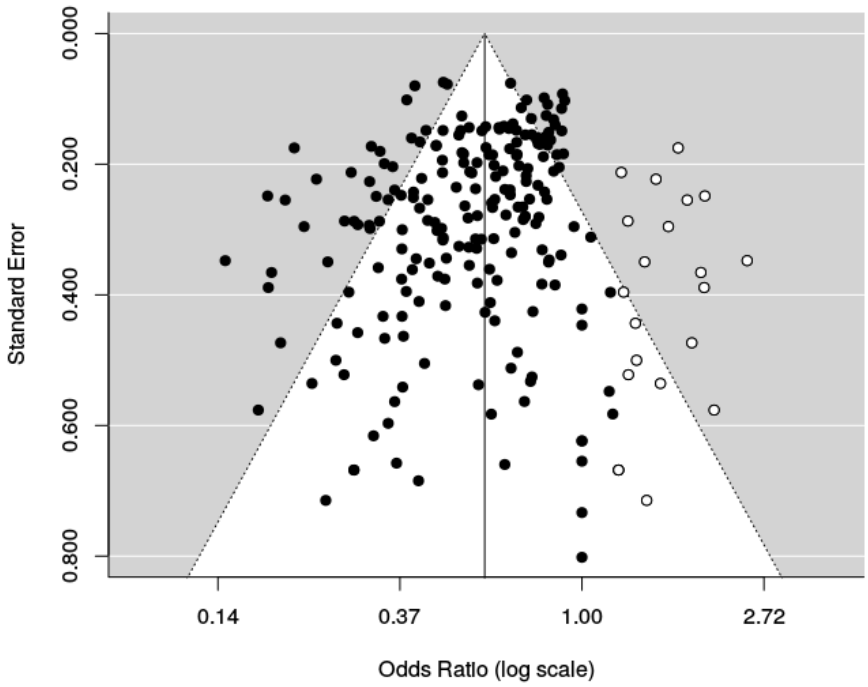


Figure 2: Funnel Plot for Subgroup Level

## S13. Multivariate Regression Analysis

Dependent variable: log odds ratio. Positive values denote higher odds to be called back; negative values denote lower odds to be called back. For instance, the negative value for "Other countries" suggests that the odds of minority candidates being called back for a job are lower in other countries compared to German countries (reference). The model is a linear mixed-effects model (random effects model with restricted maximum-likelihood estimator (REML)). All reported coefficients are significant at $p < 0.05$. Results are reported including the Knapp and Hartung adjustment to the standard errors (Knapp and Hartung 2003).

| | M1 | M2 | M3 | M4 | M5 |
|---|---|---|---|---|---|
| Intercept | yes | yes | yes | yes | yes |
| Low skills | -0.162 | -0.280 | -0.370 | -0.181 | -0.238 |
| Medium skills (ref.) | | | | | |
| High skills | 0.280 | 0.309 | 0.175 | 0.147 | n.sig. |
| Generation 2 | | -0.354 | -0.454 | | |
| Male (ref.) | | | | | |
| Female | | | n.sig. | | |
| German-speaking (ref.) | | | | | |
| Other countries | | | | -0.297 | |
| Other nationality (ref.) | | | | | |
| Indian/Pakistani | | | | | 0.314 |
| Turkish | | | | | 0.500 |
| $AIC_C$ | 186.9 | 152.0 | 127.9 | 174.1 | 36.3 |

## References


Bendick, Marc, Charles W Jackson, Victor A Reinoso, and Laura E Hodges. 1991. 'Discrimination against Latino job applicants: A controlled experiment'. *Human Resource Management* 30 (4):469-484.

Knapp, Guido, and Joachim Hartung. 2003. 'Improved Tests for a Random Effects Meta-Regression with a Single Covariate'. *Statistics in Medicine* 22 (17): 2693–2710.

World Bank. 2015. *World Development Indicators*. Washington D.C.: World Bank. http://data.worldbank.org/data-catalog/world-development-indicators.