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DISCRIMINATION AGAINST MOBILE EU CITIZENS BEFORE AND DURING THE FIRST COVID-19 LOCKDOWN: EVIDENCE FROM A CONJOINT EXPERIMENT IN GERMANY

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1

Introduction

This report presents the data analysis for “Discrimination against mobile EU citizens before and during the first Covid-19 lockdown: evidence from a conjoint experiment in Germany”, published in the *European Union Politics*.

Generate a variable of exposure to COVID made up of the combination between:

- ```
Original data can be retrieved from:
https://www.destatis.de/DE/Themen/Laender-Regionen/Regionales/Gemeindeverzeichnis/Administrativ/02-bundes
url.population <- "https://www.destatis.de/DE/Themen/Laender-Regionen/Regionales/Gemeindeverzeichnis/Admini
#download.file(url.population, destfile = "02-bundeslaender.xlsx")

population <- read_excel("02-bundeslaender.xlsx",
 sheet = 2, skip = 7,
 col_names = FALSE) %>%

 select(Region= `... 1`,
 Population = `... 4`) %>%
 filter(!is.na(Population)) %>%
 filter(!is.na(Region)) %>%
 mutate(Region = str_sub(Region, 5, -1)) %>%
 mutate(Population = as.integer(Population))
```

```
source("load_packages.R")
url.covid.rki <- "https://opendata.arcgis.com/datasets/dd4580c810204019a7b8eb3e0b329dd6_0.csv"
Uncomment the following line if you need to download the file automatically
download.file(url.covid.rki, destfile = "dd4580c810204019a7b8eb3e0b329dd6_0.csv")
or better yet, download it manually, as it is very large as of June 2021 (>300
Mb), and download.file() may not handle it.
covid.orig <- read.csv("dd4580c810204019a7b8eb3e0b329dd6_0.csv")
head(covid.orig)
```

| ## | ObjectId   | IdBundesland    | Bundesland             | Landkreis    | Altersgruppe | Geschlecht |
|----|------------|-----------------|------------------------|--------------|--------------|------------|
| ## | 1          | 1               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | 2          | 2               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | 3          | 3               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | 4          | 4               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | 5          | 5               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | 6          | 6               | Schleswig-Holstein     | SK Flensburg | A00-A04      | M          |
| ## | AnzahlFall | AnzahlTodesfall | Meldedatum             | IdLandkreis  |              |            |
| ## | 1          | 0               | 2020/09/30 00:00:00+00 | 1001         |              |            |
| ## | 2          | 0               | 2020/10/29 00:00:00+00 | 1001         |              |            |

```
3 1 0 2020/11/03 00:00:00+00 1001
4 1 0 2020/11/20 00:00:00+00 1001
5 1 0 2020/11/23 00:00:00+00 1001
6 1 0 2020/12/18 00:00:00+00 1001
Datenstand NeuerFall NeuerTodesfall Refdatum
1 18.06.2021, 00:00 Uhr 0 -9 2020/09/30 00:00:00+00
2 18.06.2021, 00:00 Uhr 0 -9 2020/10/29 00:00:00+00
3 18.06.2021, 00:00 Uhr 0 -9 2020/11/03 00:00:00+00
4 18.06.2021, 00:00 Uhr 0 -9 2020/11/19 00:00:00+00
5 18.06.2021, 00:00 Uhr 0 -9 2020/11/18 00:00:00+00
6 18.06.2021, 00:00 Uhr 0 -9 2020/12/14 00:00:00+00
NeuGenesen AnzahlGenesen IstErkrankungsbeginn Altersgruppe2
1 0 1 0 Nicht übermittelt
2 0 1 0 Nicht übermittelt
3 0 1 0 Nicht übermittelt
4 0 1 1 Nicht übermittelt
5 0 1 1 Nicht übermittelt
6 0 1 1 Nicht übermittelt
```

Only work with the data up to the maximum date in which sampling was done. Calculate a 5-days moving average for infection rates on 100,000 inhabitants.

```
load("sample-eup.RData")
dates.main <- range(I$DateCompleted[I$Sample=="Main"])
dates.crisis <- range(I$DateCompleted[I$Sample=="Crisis"])

Original data contains entries by age group and sex, and at the Landkreis (local) level
We remove that and group by region and by date
covid <- covid.orig %>%
 tibble() %>%
 select(Region = Bundesland,
 Date = Meldedatum,
 Infected = AnzahlFall,
 Death = AnzahlTodesfall) %>%
 mutate(Date = as.Date(str_sub(Date, start = 1, end = 10),
 format = "%Y/%m/%d")) %>%
 # Avoid days greater than one month after the last day of sampling
 filter(Date <= (max(I$DateCompleted) + 30)) %>%
 # Filter Infected and Death with -1
 filter(Infected >= 0 & Death >= 0)

Calculate total cases grouping age groups and sex
covid <- covid %>%
 group_by(Region, Date) %>%
 summarize(Infected = sum(Infected),
 Death = sum(Death)) %>%
 ungroup() %>%
 # Merge with population
 left_join(population)

Calculate cumulative cases and infection rates
covid.cum <- covid %>%
 group_by(Region) %>%
 arrange(Region, Date) %>%
 mutate(Infected = cumsum(Infected),
 Death = cumsum(Death)) %>%
 mutate(`Infection rate` = Infected / Population * 1e5,
 `Death rate` = Death / Population * 1e5) %>%
 mutate(`Infection growth rate` = (Infected - lag(Infected)) / lag(Infected),
 `Death growth rate` = (Death - lag(Death)) / lag(Death)) %>%
 mutate(`Infection growth rate smoothed` = zoo::rollmean(`Infection growth rate`, k = 5, fill = NA),
 `Death growth rate smoothed` = zoo::rollmean(`Death growth rate`, k = 5, fill = NA))
```



```
covid.cum %>%
 ggplot(aes(x = Date, y = `Infection rate`, group = Region)) +
 geom_line()
```

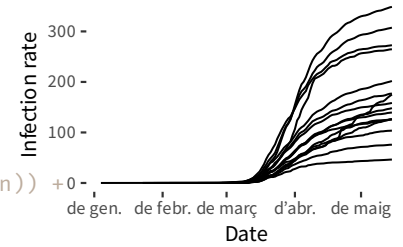


Figure 2.1: Infection rate by 100,000 inhabitants

```
covid.cum %>%
 ggplot(aes(x = Date, y = `Infection growth rate`, group = Region)) +
 geom_line()
```

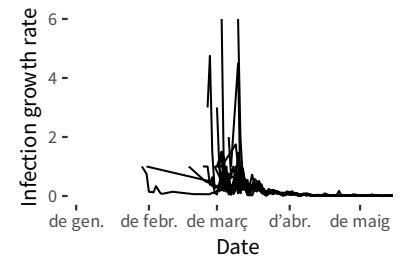


Figure 2.2: Infection rate daily growth rate

```
covid.cum %>%
 ggplot(aes(x = Date, y = `Infection growth rate smoothed`, group = Region)) +
 geom_rect(inherit.aes = FALSE,
 aes(xmin = dates.main[1], xmax = dates.main[2],
 ymin = -Inf, ymax = Inf),
 color = "transparent", fill = "gray", alpha = 0.1) +
 geom_rect(inherit.aes = FALSE,
 aes(xmin = dates.crisis[1], xmax = dates.crisis[2],
 ymin = -Inf, ymax = Inf),
 color = "transparent", fill = "gray", alpha = 0.2) +
 geom_line()
```

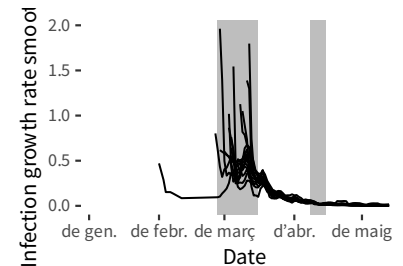


Figure 2.3: Infection rate daily growth rate

```
f1 <- covid.cum %>%
 ggplot(aes(x = Date, y = (`Infection rate`))) +
 geom_rect(inherit.aes = FALSE,
 aes(xmin = dates.main[1], xmax = dates.main[2],
 ymin = -Inf, ymax = Inf),
 color = "transparent", fill = "gray", alpha = 0.1) +
 geom_rect(inherit.aes = FALSE,
 aes(xmin = dates.crisis[1], xmax = dates.crisis[2],
 ymin = -Inf, ymax = Inf),
 color = "transparent", fill = "gray", alpha = 0.2) +
 geom_line(aes(group = Region)) +
 scale_y_continuous(breaks = c(1, 10, 100, 300)) +
 coord_trans(y = "log2") +
 ylab("Infection rate\n(by 100,000 inhabitants)")
f1
```

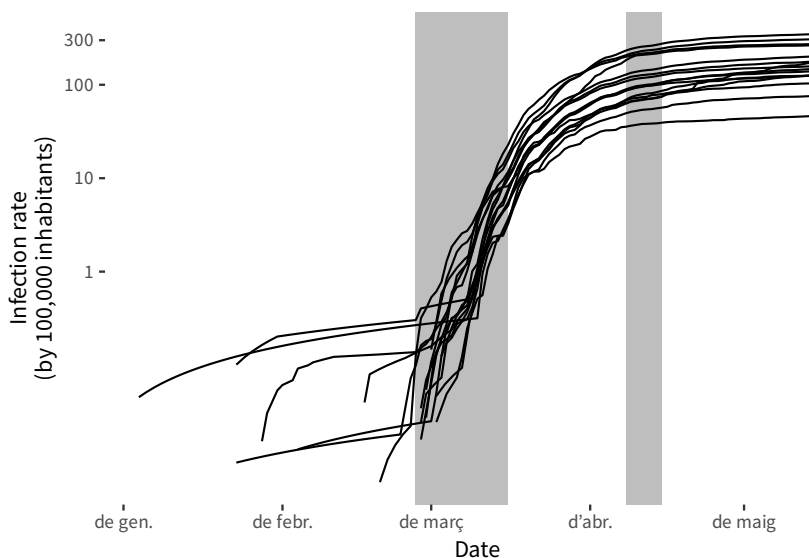


Figure 2.4: Infection rate by 100,000 inhabitants. Log scale.

```
f2 <- covid.cum %>%
 filter(Date == dates.crisis[2]) %>%
 ggplot(aes(x = `Infection rate`, y = reorder(Region, `Infection rate`))) +
```

```
geom_point() +
scale_x_continuous(breaks = c(50, 100, 300)) +
coord_trans(x = "log2") +
xlab("Infection rate\n(by 100,000 inhabitants)") +
ylab("Region") +
ggtitle(dates.crisis[2])
plot_grid(f1, f2)
```

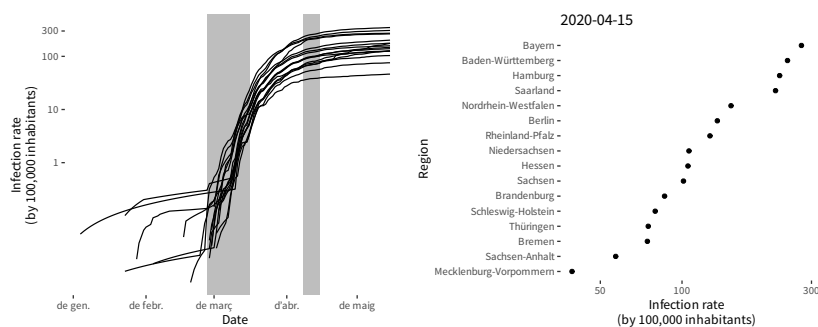


Figure 2.5: a) Temporal evolution of infection rate by 100,000 inhabitants (log scale); b) Dotplot of the infection rate by 100,000 inhabitants in the last day of the fieldword (log scale)

```
plot_grid(f1 + theme_tufte(base_family = "Helvetica"),
f2 + theme_tufte(base_family = "Helvetica"))
```

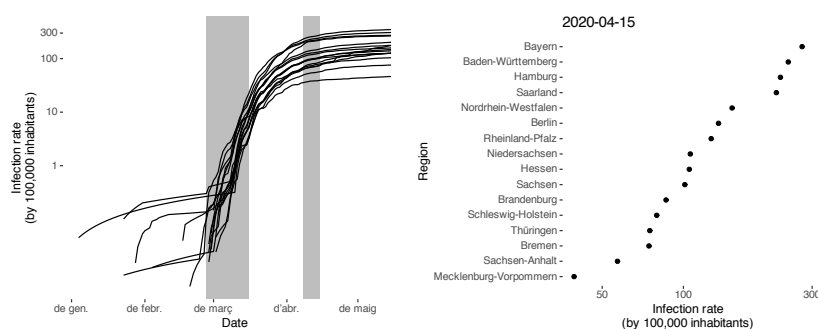


Figure 2.6: a) Temporal evolution of infection rate by 100,000 inhabitants (log scale); b) Dotplot of the infection rate by 100,000 inhabitants in the last day of the fieldword (log scale)

```
ggsave("tmp.pdf", width = 10, height = 4)
```

Define exposure as:

- the average of the last 5 days' infection rate by german region.

```
Calculate exposure
covid.exposure <- covid.cum %>%
 select(Region, Date, Exposure = `Infection rate`)

save(covid.exposure, file = "covid_exposure.RData")

source("load_packages.R")
load("sample-eup.RData")

std <- function(x) (x - mean(x, na.rm = TRUE)) / (2 * sd(x, na.rm = TRUE))
inv.logit <- function(x) return(1 / (1 + (exp(-(x))))))
logit <- function(x) return(log(x/(1-x)))
or <- function(x, significant = 2) {
 or <- as.character(signif((x - 1) * 100, significant))
 #or[or < 0] <- paste0(" ", str_replace(or[or < 0], "-", ""), "%")
 or[or < 0] <- paste0("\U25Bd ", str_replace(or[or < 0], "-", ""), "%")
 #or[or > 0] <- paste0(" ", or[or > 0], "%")
}
```

```
 or[or > 0] <- paste0("\U25B3 ", or[or > 0], "%")
 or[or == 0] <- "="
 return(or)
}
Add exposition data on covid
load("covid_exposure.RData")
I <- left_join(I, covid.exposure, by = c("Region" = "Region", "DateCompleted" = "Date"))
run.pcp <- TRUE
run.full.beta <- TRUE
```



### 3

*Model: decision, individual, comprehensive (crisis/no crisis), attitudes, exposition/vulnerability (simplified)*

The reference respondent has the following characteristics:

- German citizen
- Female
- Average age
- Average ideology
- Average openness
- Treatment not shown
- General population

Therefore, the values of the Intercept correspond to this individual.

```
d <- E %>%
 mutate(Observation = 1:n())
di <- I

Y <- d$Decision
n0 <- length(Y)

X <- d %>%
 mutate(`Nationality Netherlands` = ifelse(Nationality == "Netherlands", 1, 0)) %>%
 mutate(`Gender Male` = ifelse(Gender == "Male", 1, 0)) %>%
 mutate(`Profession Nurse` = ifelse(Profession == "Nurse", 1, 0)) %>%
 mutate(`Language Full` = ifelse(Language == "Full", 1, 0)) %>%
 mutate(`Age 25` = ifelse(Age == "25", 1, 0)) %>%
 mutate(`Age 55` = ifelse(Age == "55", 1, 0)) %>%
 mutate(`First shown` = ifelse(ProfileOrder == 1, 1, 0)) %>%
 select(`Nationality Netherlands`,
 `Gender Male`,
 `Profession Nurse`,
 `Language Full`,
 `Age 25`,
 `Age 55`,
 `First shown`) %>%
 as.matrix()
X <- cbind("(Intercept)" = 1, X)
nF <- dim(X)[[2]]
feature.label <- dimnames(X)[[2]]

b0 <- rep(0, nF)
B0 <- diag(nF)
diag(B0) <- 2.5^-2
diag(B0) <- 1^-2

id.outcome <- as.numeric(d$Outcome)
outcome.label <- levels(d$Outcome)
```

```

nOutcome ← length(outcome.label)

id.exercise ← d$Exercise
exercise.label ← sort(unique(d$Exercise))
nE ← length(exercise.label)

id.population ← as.numeric(d$Population)
population.label ← levels(d$Population)
nP ← length(population.label)
ind.id.population ← as.numeric(di$Population)

id.treatment ← as.numeric(d$Treatment)
treatment.label ← levels(d$Treatment)
nT ← length(treatment.label)

first.shown.profile ← ifelse(d$ProfileOrder == 1, 1, 0)

id.sample ← as.numeric(d$Sample)
sample.label ← levels(d$Sample)
nS ← length(sample.label)
ind.id.sample ← as.numeric(di$Sample)

id ← d$id
nId ← length(unique(d$id))

Process the individual-level data with respondent characteristics
and convert it into a matrix as the previous 'X'
C ← di %>%
 mutate(Male = ifelse(Gender == "Male", 1, 0)) %>%
 mutate(`Age (≥ 60)` = ifelse(Age ≥ 60, 1, 0)) %>%
 mutate(`Education (Primary)` = ifelse(Education == "Primary", 1, 0)) %>%
 mutate(`Ideology (right)` = std(Ideology)) %>%
 mutate(`Income (Low)` = ifelse(Income %in% c("unter EUR 500", "EUR 500 bis unter EUR 1.000"), 1, 0)) %>%
 mutate(Migrant = ifelse(Migration == "Yes", 1, 0)) %>%
 mutate(`Crisis sample` = ifelse(Sample == "Crisis", 1, 0)) %>%
 mutate(`Treatment shown` = ifelse(Treatment == "Shown", 1, 0)) %>%
 # Exposure is standardized by each Sample
 group_by(Sample) %>%
 mutate(Exposure = std(Exposure)) %>%
 ungroup() %>%
 select(Male,
 `Age (≥ 60)`,
 `Education (Primary)`,
 `Ideology (right)`,
 `Treatment shown`,
 `Income (Low)`,
 Migrant,
 Exposure,
) %>%
 as.matrix()
C ← cbind("(Intercept)" = 1, C)
nCov ← dim(C)[2]
covariate.label ← dimnames(C)[[2]]
cov.missing ← which(apply(C, 2, function(x) ifelse(length(which(is.na(x))) > 0, TRUE, FALSE)))

c0 ← rep(0, nCov)
C0 ← diag(nCov)
diag(C0) ← 2.5^-2

D ← list(
 n0 = n0,
 id_outcome = id.outcome, nOutcome = nOutcome,
 id_exercise = id.exercise, nE = nE,
 id_population = id.population, nP = nP,
 ind_id_sample = ind.id.sample, nS = nS,
 ind_id_population = ind.id.population,
 id_treatment = id.treatment, nT = nT,
 first_shown_profile = first.shown.profile,
 X = unname(X), nF = nF, b0 = b0, B0 = B0,
 C = unname(C), nCov = nCov, c0 = c0, C0 = C0,
 cov.missing = unname(cov.missing),

```

```

id = id, nId = nId,
Y = Y)

Arrange an object to prepare a table comparing samples
d.sample <- di %>%
 select(Sample,
 Gender, Age, Education, Ideology, Migration, Income) %>%
 mutate(`Income availability` = ifelse(is.na(Income), "Reported", "Not reported")) %>%
 mutate(`Income level (low)` = ifelse(Income %in% c("unter EUR 500",
 "EUR 500 bis unter EUR 1.000",
 "EUR 1.000 bis unter EUR 1.500"),
 "Below €1,500", "Above €1,500")) %>%
 mutate(`Income level (high)` = ifelse(Income %in% c("EUR 10.000 und mehr",
 "EUR 5.000 bis unter EUR 10.000",
 "EUR 4.500 bis unter EUR 5.000",
 "EUR 4.000 bis unter EUR 4.500"),
 "Above €4,000", "Below €4,000")) %>%
 mutate(Income = as.character(Income)) %>%
 mutate(Income = str_replace_all(Income, "EUR ", "")) %>%
 mutate(Income = str_replace(Income, " bis unter ", "-")) %>%
 mutate(Income = ifelse(Income == "unter 500", "<500", Income)) %>%
 mutate(Income = ifelse(Income == "10.000 und mehr", ">10.000", Income)) %>%
 mutate(Income = str_replace_all(Income, "\\.", ",")) %>%
 mutate(Income = ifelse(is.na(Income), "Not reported", Income)) %>%
 mutate(Income = as.factor(Income)) %>%
 select(-Income)

library(compareGroups)
cg <- compareGroups(Sample ~ ., data = d.sample)
tb <- createTable(cg)

tc <- "Odds ratio of expected grand-effects, sorted by magnitude."
if (knitr::is_latex_output()) {
 export2html(tb, file = "table-descriptives-comparison-samples.html")
 input(table-descriptives-comparison-samples.html)
} else {
 export2latex(tb, file = "table-descriptives-comparison-samples.tex")
 input(table-descriptives-comparison-samples.tex)
}

cat('input{table-descriptives-comparison-samples}')

input{table-descriptives-comparison-samples}

cat("table-descriptives-comparison-samples.html")

```

Model description:

|                                |                                               |                                                         |
|--------------------------------|-----------------------------------------------|---------------------------------------------------------|
| $Y_o \sim$                     | $\mathcal{B}(\pi_o)$                          | Main data component                                     |
| $\pi_o =$                      | $\text{logit}(\beta_{i,O,f} F_{o,f})$         | Linear relationship                                     |
| $\beta_{i,O,f} \sim$           | $\mathcal{MN}(\mu_{i,O,f}, \Sigma_{\beta_O})$ |                                                         |
| $\Sigma_{\beta_O} \sim$        | $\mathcal{IW}(0, 9)$                          | VCov for individual effects                             |
| $\mu_{i,O,f} =$                | $(\theta_{O,f,s,v} C_{i,v})$                  | Explanation of individual behavior                      |
| $\theta_{O,f,s,v} \sim$        | $\mathcal{N}(\omega_{O,f}, \sigma_\theta)$    | Priors for explanatory variables of individual behavior |
| $\omega_{O,f} \sim$            | $\mathcal{N}(0, 2.5)$                         | Prior for the effects shared by outcome                 |
| $\sigma_{\theta_{O,f,v}} \sim$ | $\mathcal{U}(0, 1)$                           | Prior for SD of individual behavior                     |

Where:

- $Y$ : Outcome variable capturing whether a profile has been prioritized (1) or not (0).

- $o$ : Observation
- $o$ : Outcomes (Welfare/ Rights)
- $s$ : Sample (Main / Crisis)
- $t$ : Treatment (Shown / Not shown)
- $F$ : Matrix with the observations of features (the discrimination sources, plus intercept and first shown profile), for each experimental data point.
- $C$ : Matrix with the characteristics  $v$  of the respondents, including their population  $p$  and the treatment  $t$ .
- $f$ : Feature
- $\theta_{O,f,s,v}$ : Main parameters of interest capturing the individual variables affecting discrimination effects by outcome, sample and profiles' feature.
- $\omega_{O,f}$ : Hyper-parameters capturing the shared effect of individual characteristics on features over outcomes and sample.
- $\Sigma_{\beta_o}$ : Variance-covariance matrix of the individual effects prioritizing the different profiles, by outcome.
- $\sigma_\theta$ : Between outcome/sample and within feature/individual characteristic's standard deviations.

This model estimates the following number of parameters:

```
beta
(nId * nOutcome * nF) +
theta
(nOutcome * nF * nS * nCov) +
omega
(nF * nCov) +
sigma_theta
(nF * nS * nCov)

[1] 65096

M <- "Decision, Individual (Crisis comprehensive), attitudes, vulnerability/exposure, simplified"
M.lab <- "crisis-decision-individual-comprehensive-attitudes-vulnerability-exposure-simplified"
m <- "
model {
 for (o in 1:nO) {
 Y[o] ~ dbern(p[o])
 logit(p[o]) <- inprod(beta[id[o],id_outcome[o],1:nF], X[o,1:nF])
 }
 #
 # Priors for effects
 #
 for (ocm in 1:nOutcome) {
 for (id in 1:nId) {
 for (f in 1:nF) {
 beta[id,ocm,f] ~ dnorm(mu[id,ocm,f], 2.5^-2)
 }
 }
 }

 for (f in 1:nF) {
 for (ocm in 1:nOutcome) {
 for (id in 1:nId) {
 mu[id,ocm,f] <- inprod(theta[ocm,f,ind_id_sample[id],1:nCov], C[id,1:nCov])
 }
 for (cov in 1:nCov) {
 for (s in 1:nS) {
 theta[ocm,f,s,cov] ~ dnorm(omega[f,cov], tau_theta[f,cov])
 }
 }
 }
 }
 for (cov in 1:nCov) {
 omega[f,cov] ~ dnorm(0, 2.5^-2)
 tau_theta[f,cov] <- pow(sigma_theta[f,cov], -2)
 sigma_theta[f,cov] ~ dt(0, 0.5^-2, 3)T(0,)
 }
}
```



```

#
Missing data
#
for (id in 1:nId) {
 for (v in cov.missing) {
 C[id,v] ~ dnorm(0, 1^-2)
 }
}
}
}

write(m, file = paste("models/model-", M.lab, ".bug", sep = ""))
par <- NULL
par <- c(par, "theta")
par <- c(par, "sigma_theta")
par <- c(par, "omega")
par.beta <- c("beta")
par.pcp <- c("p")

adapt <- 2e2 # 7h
burnin <- 1e4 # 5e4 # 1h 30'
burnin <- 1e3
run <- 2e3
run <- 5e3
run.beta <- 100
run.p <- 100
chains <- 1
method <- "parallel"
thin <- 20
thin <- 1

t0 <- proc.time()
#rj <- run.jags(model = paste("models/model-", M.lab, ".bug", sep = ""),
data = dump.format(D, checkvalid = FALSE),
inits = inits,
modules = "glm",
n.chains = chains,
adapt = adapt,
burnin = burnin, sample = run,
thin = 1, #thin,
monitor = par, method = method, summarise = FALSE)
#s <- as.mcmc.list(rj)

my.jags <- function(seed, model, data, inits = inits, n.adapt, n.burnin, n.samples, thin) {
 require(rjags)
 load.module('glm')
 load.module('lecuyer')
 load.module('dic')
 tic()
 print(paste("Starting with seed", seed))
 toc()
 tic()
 data$seed <- seed
 print(data$seed)
 jm <- jags.model(model, n.chains = 1, n.adapt = n.adapt,
 inits = list(list(.RNG.name = "base::Super-Duper", .RNG.seed = seed)),
 data = data)
 print(paste("Initialization complete for seed", seed, ", updating ..."))
 toc()
 tic()
 update(jm, n.iter = burnin)
 print(paste("Update complete for seed", seed, ", sampling main parameters ..."))
 toc()
 tic()
 s <- coda.samples(jm, variable.names = par, n.iter = run * thin, thin = thin)
 print(paste("Main samples completed for seed", seed, ", sampling for beta ..."))
 toc()
 tic()
 s.beta <- coda.samples(jm, variable.names = par.beta, n.iter = run.beta * thin, thin = thin)
 print(paste("Beta samples completed for seed", seed, ", sampling for pcp ..."))
 toc()
 tic()
 s.pcp <- coda.samples(jm, variable.names = par.pcp, n.iter = run.p, thin = 1)
 print(paste("PCP samples completed for seed", seed, ", all OK"))
 toc()
 return(list(s, s.beta, s.pcp))
}

```

```

}

s.both <- mclapply(
 X = seq_len(chains),
 FUN = my.jags,
 model = paste("models/model-", M.lab, ".bug", sep = ""),
 data = D,
 n.adapt = adapt, n.burnin = burnin, n.samples = run, thin = thin,
 mc.preschedule = FALSE,
 mc.cores = chains)
save(s.both, file = "sboth.RData")

Not very elegant, but works now. Must be improved
s <- as.mcmc.list(list(s.both[[1]][[1]][[1]]))
s.beta <- as.mcmc.list(list(s.both[[1]][[2]][[1]]))
s.p <- as.mcmc.list(list(s.both[[1]][[3]][[1]]))

save(s, file = paste("samples-", M.lab, ".RData", sep = ""))
save(s.beta, file = paste("samples-beta-", M.lab, ".RData", sep = ""))
save(s.p, file = paste("samples-p-", M.lab, ".RData", sep = ""))
proc.time() - t0

load(file = paste("samples-", M.lab, ".RData", sep = ""))
load(file = paste("samples-beta-", M.lab, ".RData", sep = ""))

ggmcmc(ggs(s.beta, family = "^beta\\[.,", sort = FALSE),
 file = paste0("ggmcmc-beta-some-", M.lab, ".pdf"),
 plot = c("traceplot", "crosscorrelation", "caterpillar"))
ggmcmc(ggs(s, family = "^omega", sort = FALSE),
 file = paste0("ggmcmc-omega-", M.lab, ".pdf"),
 plot = c("traceplot", "crosscorrelation", "caterpillar"))
ggmcmc(ggs(s, family = "^theta\\[1,", sort = FALSE),
 file = paste0("ggmcmc-theta-", M.lab, ".pdf"),
 plot = c("traceplot", "crosscorrelation", "caterpillar"))
ggmcmc(ggs(s, family = "^omega", sort = FALSE),
 file = paste0("ggmcmc-publication-omega-", M.lab, ".pdf"))
ggmcmc(ggs(s, family = "^theta\\[\\]^omega", sort = FALSE),
 file = paste0("ggmcmc-publication-theta-omega-", M.lab, ".pdf"))
ggmcmc(ggs(s, family = "^sigma_theta", sort = FALSE),
 file = paste0("ggmcmc-sigma_theta-", M.lab, ".pdf"),
 plot = c("traceplot", "crosscorrelation", "caterpillar"))
ggmcmc(ggs(s, family = "sigma"),
 file = paste0("ggmcmc-sigma-", M.lab, ".pdf"),
 plot = c("traceplot", "crosscorrelation", "caterpillar"))

L.sigma.theta <- plab("sigma_theta", list(Feature = feature.label,
 Covariate = covariate.label))
S.sigma.theta <- ggs(s, family = "sigma_theta", par_labels = L.sigma.theta)
ggs_caterpillar(S.sigma.theta, label = "Feature") + #, comparison = "Sample" +
 facet_wrap(~ Covariate)
ggs_caterpillar(S.sigma.theta, label = "Covariate", comparison = "Sample") +
 facet_wrap(~ Feature)

```

### 3.1 Part-worth contributions

Figure 3.1 shows the slopes for the effect of “Nationality Netherlands” on Rights, for each individual in the sample, sorted by the strength of their effect.

Individual 70 is the one more likely to discriminate favouring Dutch citizens, and individual 47 is the one more likely to discriminate against them.

Higher uncertainties imply that the information in the 6 experiments is less conclusive. It may be because the signal they sent when prioritizing is less clear, or because by chance the profiles shown were less relevant to extract such signal (indeed, individual 33 is qualified as “poor quality”).

```
L.beta <- plab("beta", list(id = 1:nId,
 Outcome = outcome.label,
 Feature = feature.label)) %>%
 mutate(id = as.numeric(as.character(id))) %>%
 left_join(select(di, id, Sample, Treatment))
S.beta <- ggs(s.beta, family = "^beta\\[", par_labels = L.beta, sort = FALSE) %>%
 select(-c(dim.1, dim.2, dim.3))

Save memory and remove the objects once the ggs() has been applied
rm(s.beta)
invisible(gc())

S.beta %>%
 filter(Outcome = "Rights" &
 Feature = "Nationality Netherlands") %>%
ggs_caterpillar(label = "id") +
 ylab("Individual id") +
 aes(color = Sample) +
 geom_vline(xintercept = 0, col = "red") +
 theme(axis.text = element_text(size = rel(0.5))) +
 scale_color_discrete_qualitative(palette = "Dynamic")

ggs_caterpillar(S.beta %>%
 filter(Outcome = "Rights" &
 Feature = "Language Full"),
 label = "id") +
 ylab("Individual id") +
 aes(color = Sample) +
 geom_vline(xintercept = 0, col = "red") +
 theme(axis.text = element_text(size = rel(0.5))) +
 scale_color_discrete_qualitative(palette = "Dynamic")

ggs_caterpillar(S.beta %>%
 filter(Outcome = "Welfare" &
 Feature = "Age 25"),
 label = "id") +
 ylab("Individual id") +
 aes(color = Sample) +
 geom_vline(xintercept = 0, col = "red") +
 theme(axis.text = element_text(size = rel(0.5))) +
 scale_color_discrete_qualitative(palette = "Dynamic")

ci.beta <- S.beta %>%
 ci() %>%
 filter(Feature != "(Intercept)") %>%
 select(id, Outcome, Feature, median)

order.beta.mean <- ci.beta %>%
 group_by(Feature) %>%
 summarize(Mean = mean(median)) %>%
 arrange(desc(Mean)) %>%
 mutate(Feature = as.character(Feature)) %>%
 select(Feature) %>%
 unlist(use.names = FALSE)

ci.beta.bins <- ci.beta %>%
 mutate(interval = cut(median, breaks = seq(-8, 9, 0.1))) %>%
 group_by(Outcome, Feature, interval) %>%
 count() %>%
 mutate(value = ifelse(str_detect(interval, "-"), "Negative", "Positive")) %>%
```

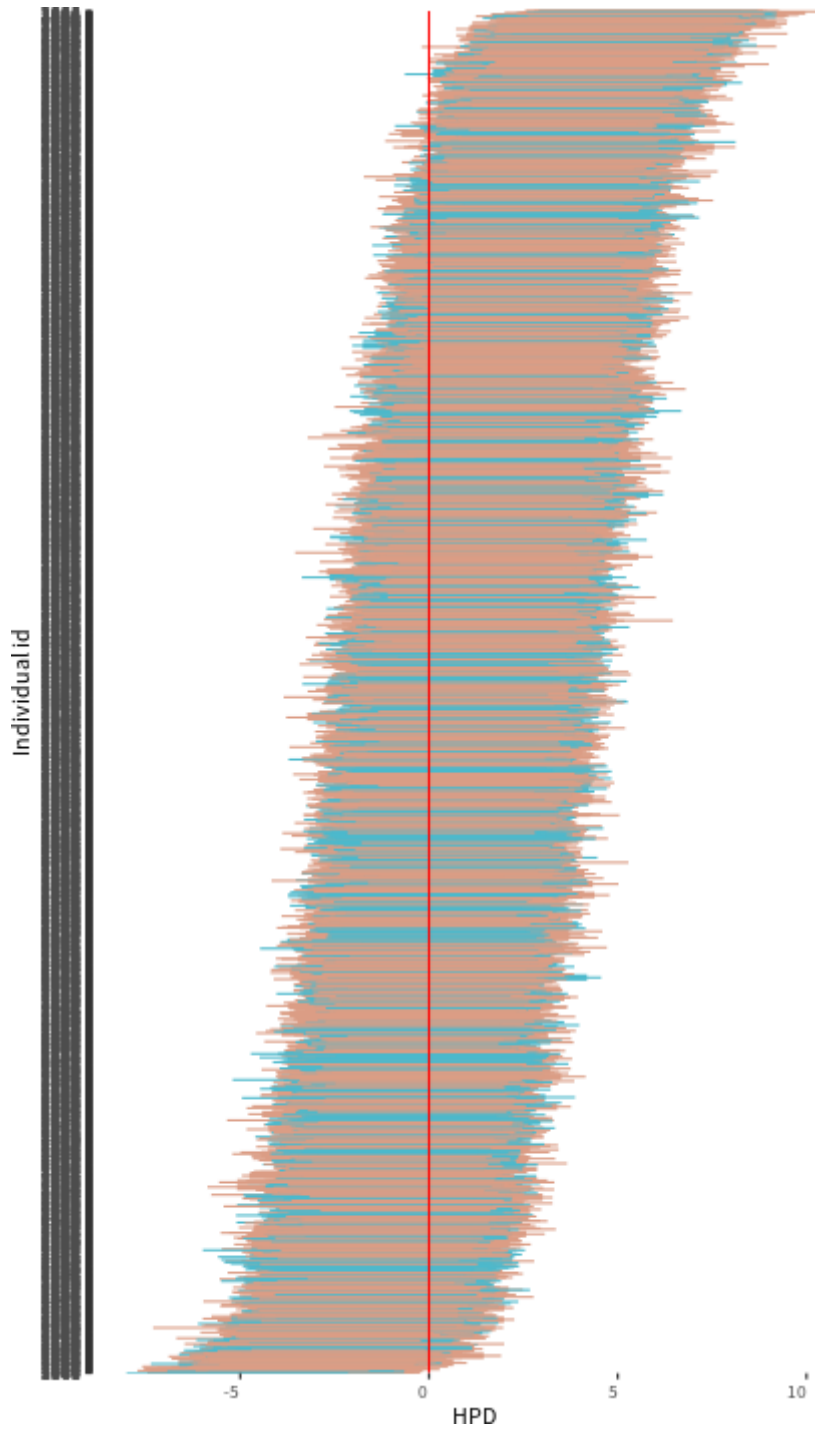


Figure 3.1: Discrimination on Nationality (Netherlands) on rights, by each individual in the sample.

```
ungroup() %>%
mutate(Feature = factor(as.character(Feature), levels = order.beta.mean))
ggplot(ci.beta.bins, aes(x = interval, y = n, color = value, fill = value)) +
 geom_bar(stat = "identity") +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 guides(color = "none", fill = "none") +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0))
```



Figure 3.2: Distribution of the mean values for each individuals' utilities. Colors represent positive/negative utilities.

```
ci.beta %>%
ggplot(aes(x = median, color = Outcome, fill = Outcome)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ .) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_qualitative(palette = "Dark 2")
```

```
ci.beta %>%
 left_join(select(di, id, Sample)) %>%
 filter(Feature != "First shown") %>%
ggplot(aes(x = median, y = ..density..)) +
 geom_histogram(data = . %>% filter(Sample == "Main")) +
 geom_density(data = . %>% filter(Sample == "Crisis")) +
```

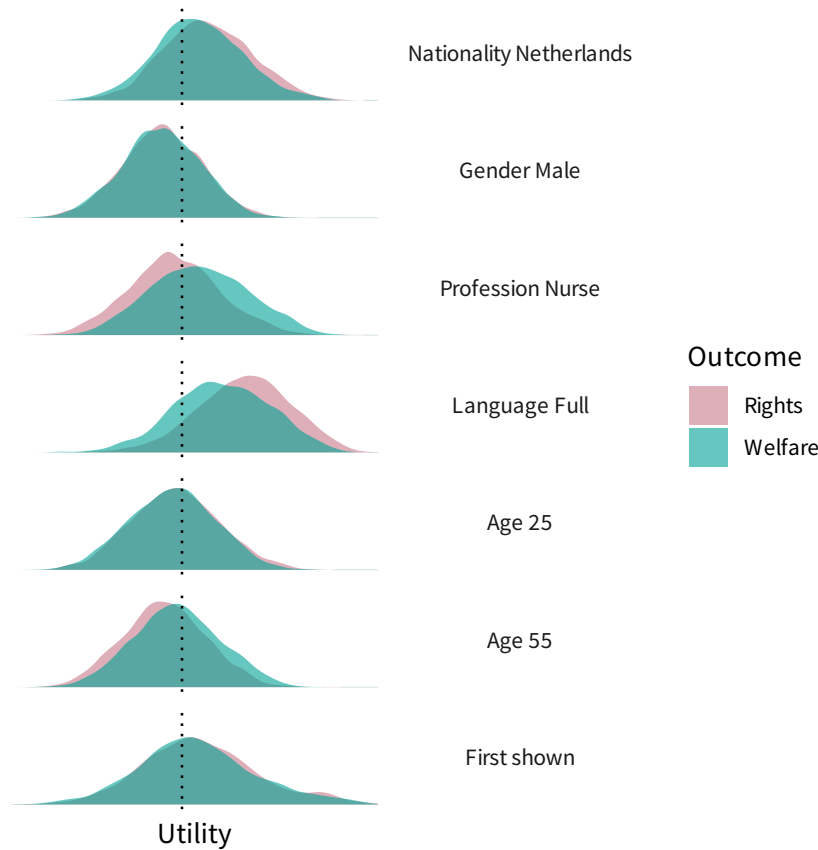


Figure 3.3: Distribution of the mean values for each individuals' utilities, by outcome.

```

facet_grid(Feature ~ Outcome) +
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0))

ci.beta %>%
left_join(select(di, id, Sample)) %>%
filter(Feature != "First shown") %>%
mutate(Feature = factor(as.character(Feature), levels = order.beta.mean)) %>%
ggplot(aes(x = median, y = ..density..)) +
geom_histogram(data = . %>% filter(Sample = "Main"),
binwidth = 0.1) +
geom_density(data = . %>% filter(Sample = "Crisis"),
lwd = 1.5) +
facet_grid(Feature ~ Outcome) +
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
scale_x_continuous(breaks = logit(c(0.01, 0.1, 0.5, 0.9, 0.99)),
labels = paste(c(0.01, 0.1, 0.5, 0.9, 0.99) * 100, "%", sep = "")) +
theme(axis.ticks.y = element_blank(),
axis.text.y = element_blank(),
strip.text.y = element_text(angle = 0))

ci.beta %>%
left_join(select(di, id, Sample)) %>%
filter(Feature != "First shown") %>%
ggplot(aes(x = median, y = ..density..)) +
geom_density(data = . %>% filter(Sample = "Main"), lwd = 1) +
geom_density(data = . %>% filter(Sample = "Crisis"), color = "grey70", lwd = 1) +
facet_grid(Feature ~ Outcome) +

```

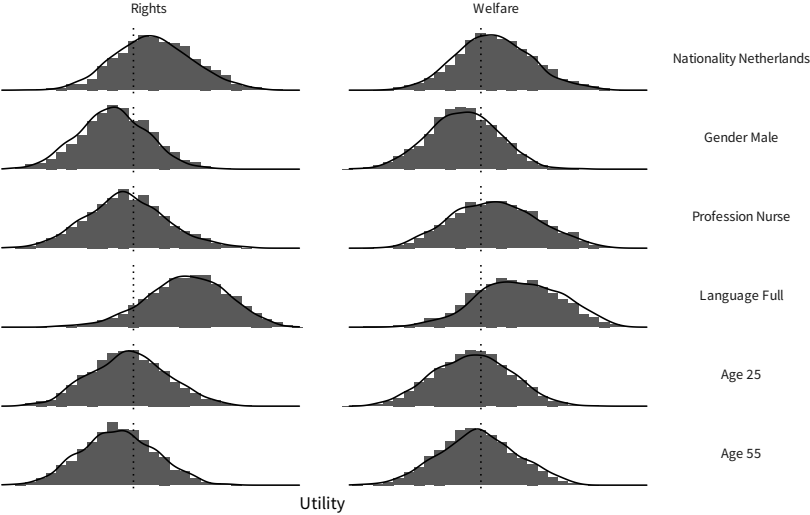


Figure 3.4: Distribution of the mean values for each individuals' utilities, by sample and outcome.

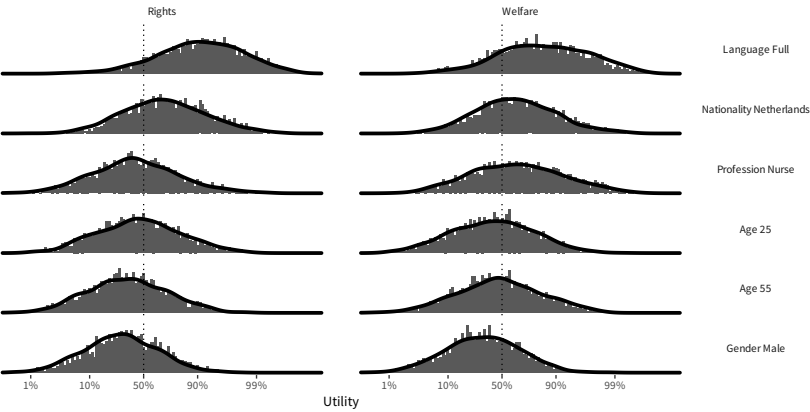


Figure 3.5: Distribution of the mean values for each individuals' utilities, by sample and outcome.

```

xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0))

```

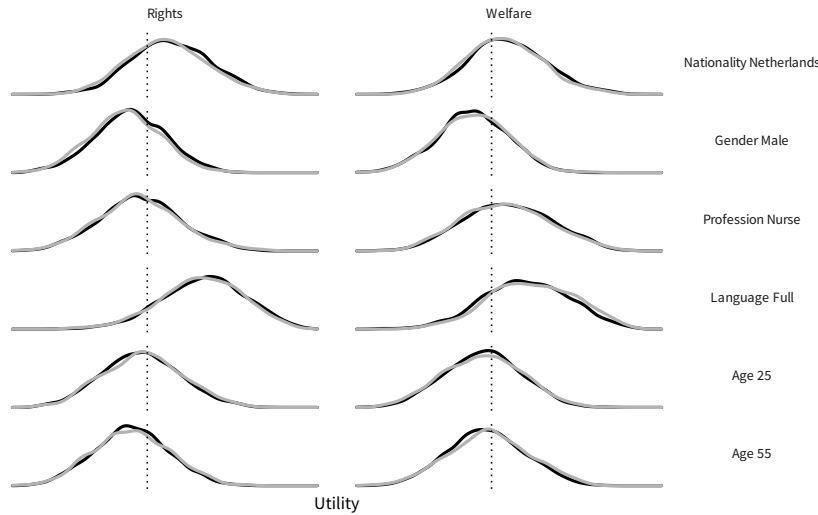


Figure 3.6: Distribution of the mean values for each individuals' utilities, by sample and outcome.

```

ci.beta %>%
left_join(select(di, id, Sample)) %>%
ggplot(aes(x = median, fill = Sample)) +
geom_density(alpha = 0.6, color = NA) +
facet_grid(Feature ~ Outcome) +
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0)) +
scale_fill_discrete_qualitative(palette = "Dynamic")

```



Figure 3.7: Distribution of the mean values for each individuals' utilities, by sample.

```

ci.beta %>%
left_join(select(I, id, Treatment)) %>%
ggplot(aes(x = median, fill = Treatment)) +
geom_density(alpha = 0.6, color = NA) +

```



```
facet_grid(Feature ~ Outcome) +
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0)) +
scale_fill_discrete_qualitative(palette = "Harmonic")
```

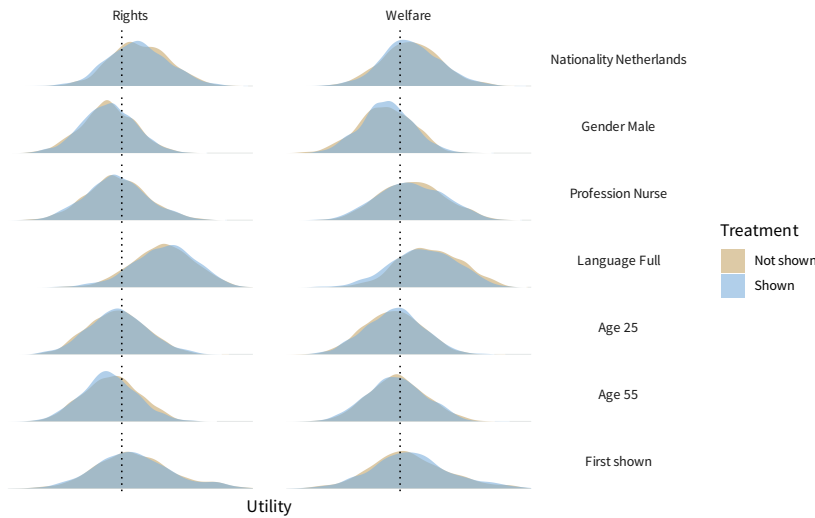


Figure 3.8: Distribution of the mean values for each individuals' utilities, by treatment.

```
ci.beta %>%
left_join(select(I, id, Migration)) %>%
ggplot(aes(x = median, fill = Migration)) +
geom_density(alpha = 0.6, color = NA) +
facet_grid(Feature ~ Outcome) +
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0)) +
scale_fill_discrete_qualitative(palette = "Warm")
```

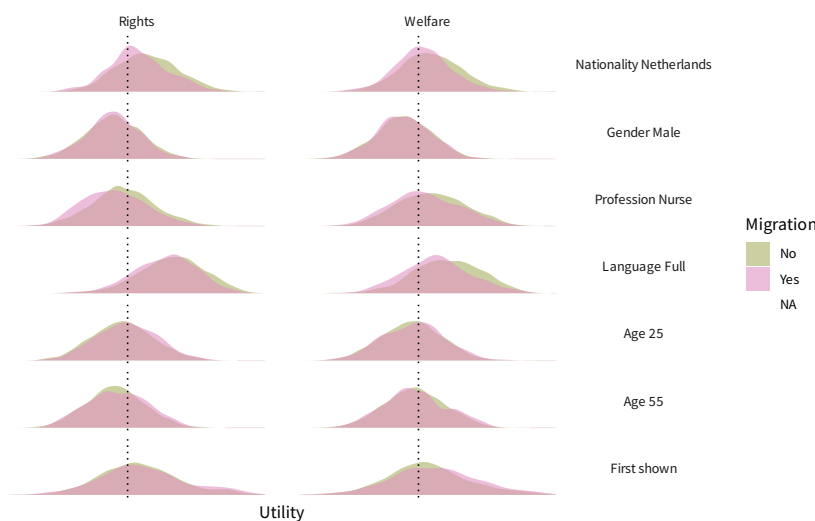


Figure 3.9: Distribution of the mean values for each individuals' utilities, by migrant.

```
ci.beta %>%
left_join(select(I, id, Gender)) %>%
```

```
ggplot(aes(x = median, fill = Gender)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_qualitative(palette = "Warm")
```

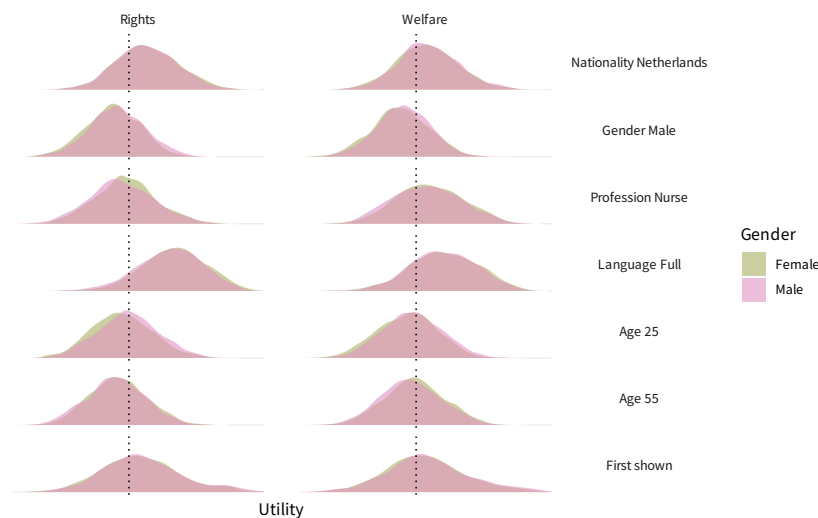


Figure 3.10: Distribution of the mean values for each individuals' utilities, by gender.

```
ci.beta %>%
 left_join(select(I, id, Education)) %>%
 ggplot(aes(x = median, fill = Education)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_qualitative(palette = "Warm")
```

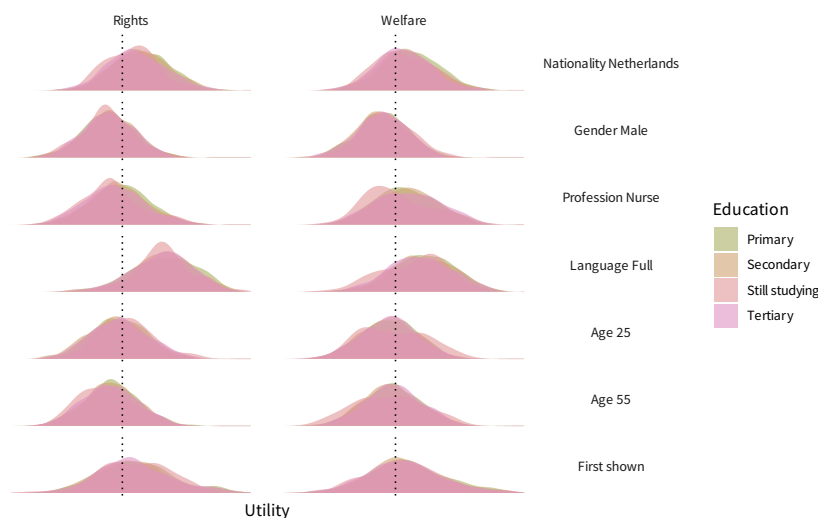


Figure 3.11: Distribution of the mean values for each individuals' utilities, by gender.

```
ci.beta %>%
 left_join(select(I, id, Age)) %>%
 mutate(`Age group` = cut(Age, breaks = c(-Inf, 30, 50, Inf))) %>%
ggplot(aes(x = median, fill = `Age group`)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_qualitative(palette = "Warm")
```



Figure 3.12: Distribution of the mean values for each individuals' utilities, by age group.

```
ci.beta %>%
 left_join(select(I, id, Ideology)) %>%
 mutate(`Ideology group` = cut(Ideology, breaks = c(-Inf, 2, 4, 5, 7, Inf))) %>%
ggplot(aes(x = median, fill = `Ideology group`)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_diverging(palette = "Blue-Red", rev = TRUE)
```

```
ci.beta %>%
 left_join(select(I, id, Income)) %>%
 mutate(`Income data` = ifelse(is.na(Income), "Missing", "Available")) %>%
ggplot(aes(x = median, fill = `Income data`)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
 xlab("Utility") + ylab(NULL) +
 geom_vline(xintercept = 0, lty = 3) +
 theme(axis.ticks = element_blank(), axis.text = element_blank(),
 strip.text.y = element_text(angle = 0)) +
 scale_fill_discrete_qualitative(palette = "Warm")
```

```
ci.beta %>%
 left_join(select(I, id, Income)) %>%
ggplot(aes(x = median, fill = Income)) +
 geom_density(alpha = 0.6, color = NA) +
 facet_grid(Feature ~ Outcome) +
```

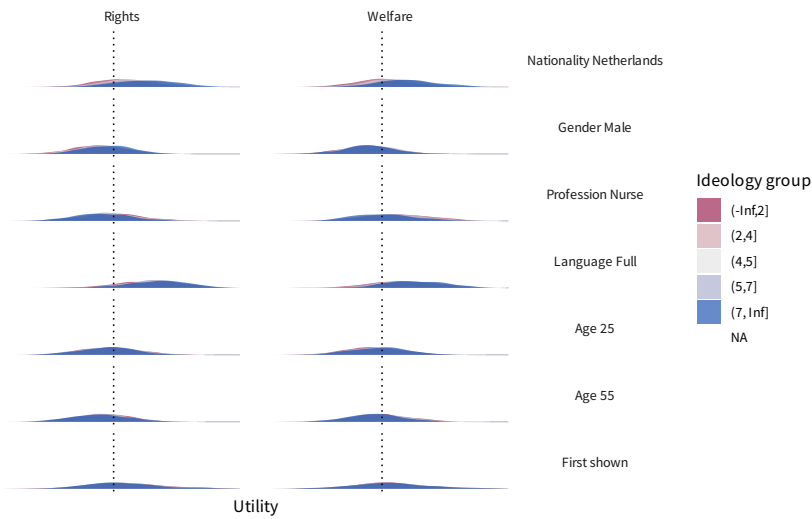


Figure 3.13: Distribution of the mean values for each individuals' utilities, by ideology group.

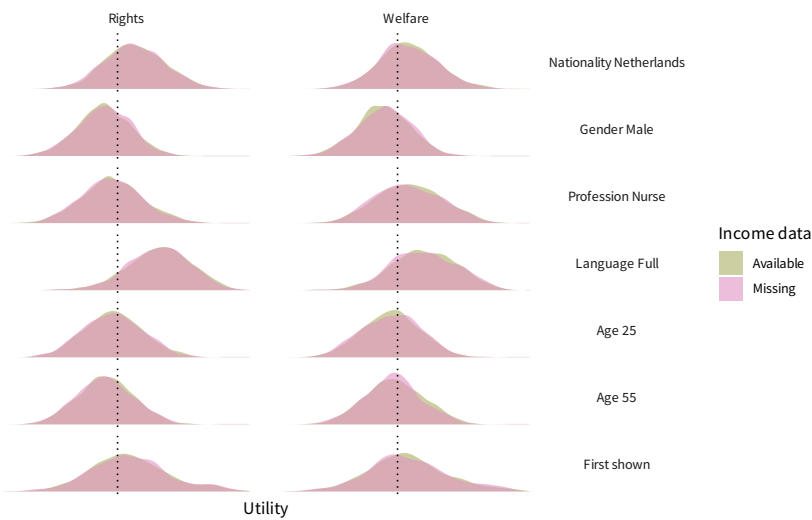


Figure 3.14: Distribution of the mean values for each individuals' utilities, by income data availability.

```
xlab("Utility") + ylab(NULL) +
geom_vline(xintercept = 0, lty = 3) +
theme(axis.ticks = element_blank(), axis.text = element_blank(),
strip.text.y = element_text(angle = 0)) +
scale_fill_discrete_sequential(palette = "Oranges", rev = TRUE)
```

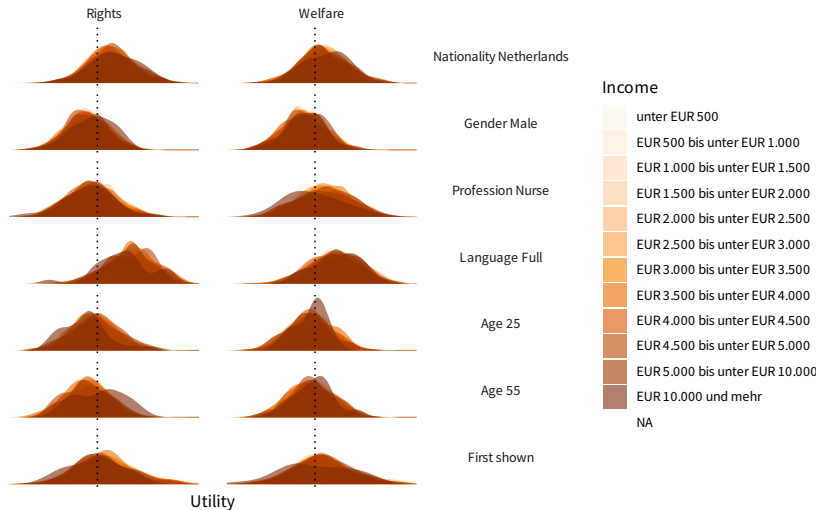


Figure 3.15: Distribution of the mean values for each individuals' utilities, by income.

Figure 3.16 presents the summary of the relationships between individual utilities in each feature.

```
ci.beta.w <- ci.beta %>%
 pivot_wider(c(id, Outcome), names_from = Feature, values_from = median)
my_dens <- function(data, mapping, ... , low = "#132B43", high = "#56B1F7") {
 ggplot(data = data, mapping=mapping) +
 geom_density(... , alpha=0.3)
}
ggpairs(select(ci.beta.w, -id),
 lower = list(continuous = wrap("points", alpha = 0.1)),
 diag = list(continuous = my_dens),
 mapping = aes(color = Outcome))
```

```
ci.beta.w <- ci.beta %>%
 filter(Outcome == "Rights") %>%
 filter(Feature != "First shown") %>%
 left_join(select(di, id, Sample)) %>%
 pivot_wider(c(id, Sample), names_from = Feature, values_from = median)
```

```
my_dens <- function(data, mapping, ...) {
 ggplot(data = data, mapping=mapping) +
 geom_density(... , alpha=0.3)
}
```

```
my_sc <- function(data, mapping, ...) {
 ggplot(data = data, mapping = mapping) +
 geom_point(alpha = 0.1) +
 geom_smooth(method = "loess")
}
```

```
ggplot <- function(...) ggplot2::ggplot(...) + scale_color_discrete_qualitative(palette = "Dynamic") + scale
unlockBinding("ggplot", parent.env(asNamespace("GGally")))
assign("ggplot", ggplot, parent.env(asNamespace("GGally")))
```

```
gpd <- select(ci.beta.w, -c(id))
ggpairs(gpd,
 columns = 2:ncol(gpd),
 title = "Rights",
```

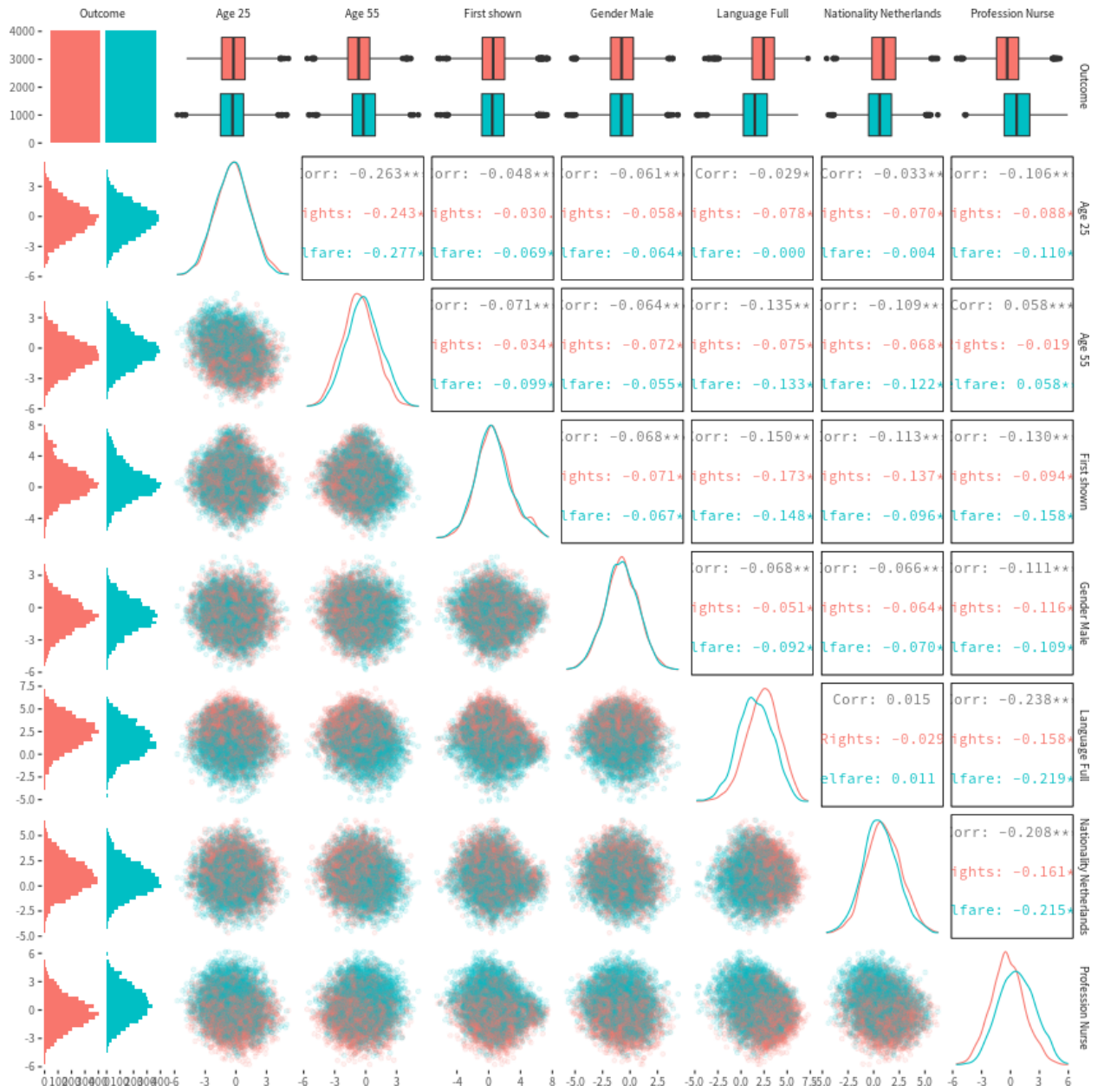


Figure 3.16: Comparison of median expected individual effects of every feature, by outcome.

```
legend = c(2, 1),
lower = list(continuous = my_sc),
diag = list(continuous = my_dens),
mapping = aes(color = Sample)) +
theme(legend.position = "bottom")
```

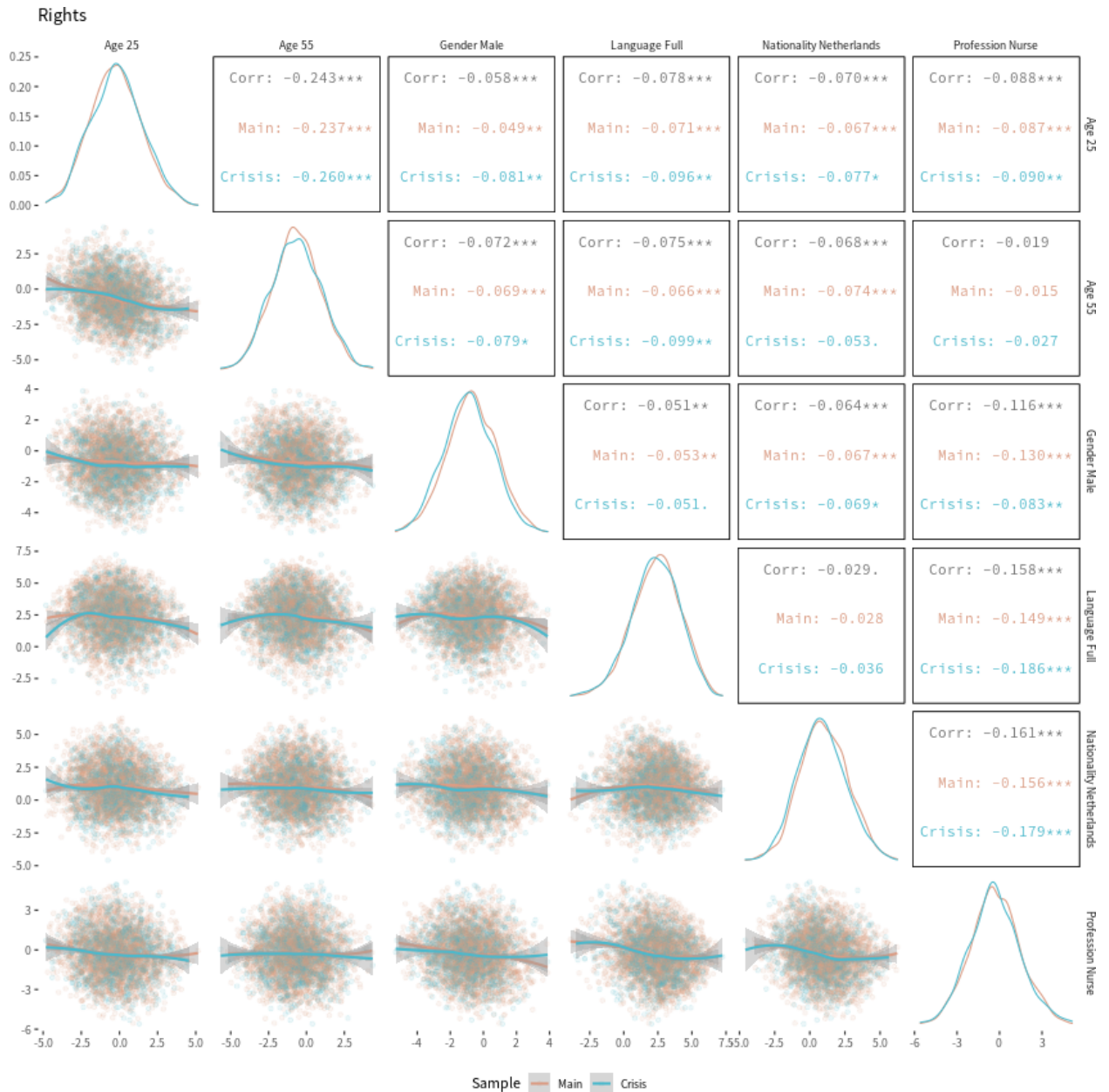


Figure 3.17: Comparison of median expected individual effects of every feature, by sample. Only rights.

```
ci.beta.w <- ci.beta %>%
 filter(Outcome == "Welfare") %>%
 filter(Feature != "First shown") %>%
 left_join(select(di, id, Sample)) %>%
 pivot_wider(c(id, Sample), names_from = Feature, values_from = median)

my_dens <- function(data, mapping, ...) {
 ggplot(data = data, mapping=mapping) +
 geom_density(... , alpha=0.3)
}
```

```
my_sc <- function(data, mapping, ...) {
 ggplot(data = data, mapping = mapping) +
 geom_point(alpha = 0.1) +
 geom_smooth(method = "lm")
}

ggplot <- function(...) ggplot2::ggplot(...) + scale_color_discrete_qualitative(palette = "Dynamic") + scale
unlockBinding("ggplot", parent.env(asNamespace("GGally")))
assign("ggplot", ggplot, parent.env(asNamespace("GGally")))

gpd <- select(ci.beta.w, -c(id))
ggpairs(gpd,
 columns = 2:ncol(gpd),
 title = "Welfare",
 legend = c(2, 1),
 lower = list(continuous = my_sc),
 diag = list(continuous = my_dens),
 mapping = aes(color = Sample)) +
 theme(legend.position = "bottom")
```

### 3.2 Attribute importance

```
importance <- function(x) {
 if (length(x) == 1) {
 return(abs(x))
 } else {
 return(max(x) - min(x))
 }
}

S.importance <- S.beta %>%
 filter(!Feature %in% c("First shown", "(Intercept)")) %>%
 ci() %>%
 select(id, Outcome, Feature, value = median) %>%
 separate(Feature, " ", into = c("Attribute", "Level")) %>%
 group_by(id, Outcome, Attribute) %>%
 summarize(Importance = importance(value))

S.relative.importance <- S.importance %>%
 group_by(id, Outcome) %>%
 mutate(`Relative importance` = Importance / sum(Importance)) %>%
 group_by(id, Outcome, Attribute) %>%
 mutate(SumRelativeImportance = sum(`Relative importance`)) %>%
 left_join(select(di, id, Sample))

S.relative.importance.nationality.order <- S.relative.importance %>%
 group_by(id, Outcome) %>%
 filter(Attribute == "Nationality") %>%
 arrange(desc(SumRelativeImportance)) %>%
 ungroup() %>%
 mutate(order = 1:n()) %>%
 select(id, Outcome, order)

S.relative.importance <- S.relative.importance %>%
 left_join(S.relative.importance.nationality.order)
save(S.relative.importance, file = paste("relative-importance-", M.lab, "-beta-relative_importance", ".RData"))

fo1 <- ggplot(filter(S.relative.importance, Outcome == outcome.label[1]),
 aes(x = reorder(id, order),
 y = `Relative importance`,
 fill = Attribute)) +
 geom_bar(position = "fill", stat = "identity") +
 xlab("Id") + ggtitle(outcome.label[1]) +
 scale_fill_brewer(type = "qual", palette = "Set1")
fo2 <- ggplot(filter(S.relative.importance, Outcome == outcome.label[2]),
 aes(x = reorder(id, order),
 y = `Relative importance`,
 fill = Attribute)) +
 geom_bar(position = "fill", stat = "identity") +
```



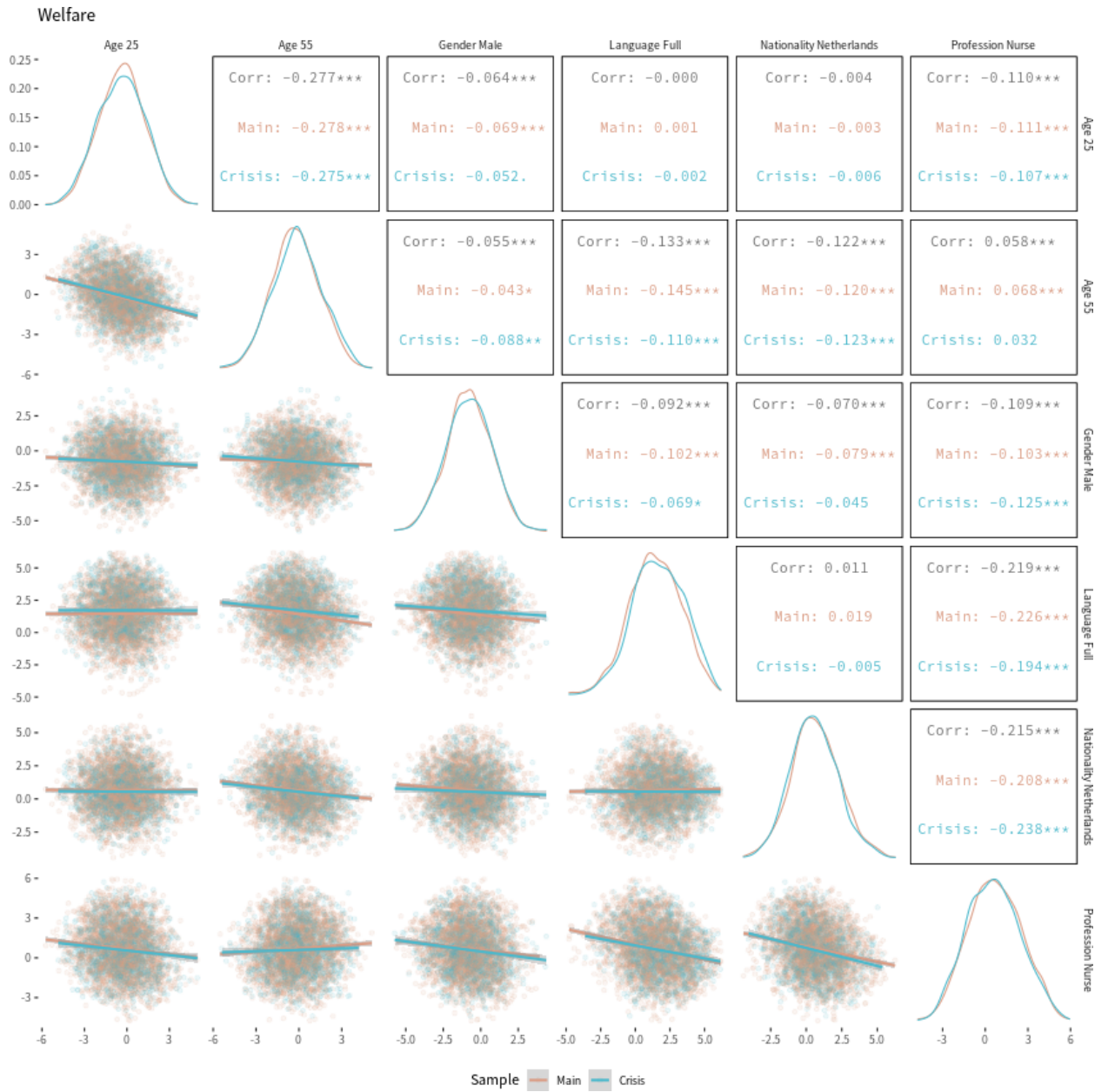


Figure 3.18: Comparison of median expected individual effects of every feature, by sample. Only welfare.

```
xlab("Id") + ggtitle(outcome.label[2]) +
scale_fill_brewer(type = "qual", palette = "Set1")
grid.arrange(fo1, fo2, nrow = 2)
```

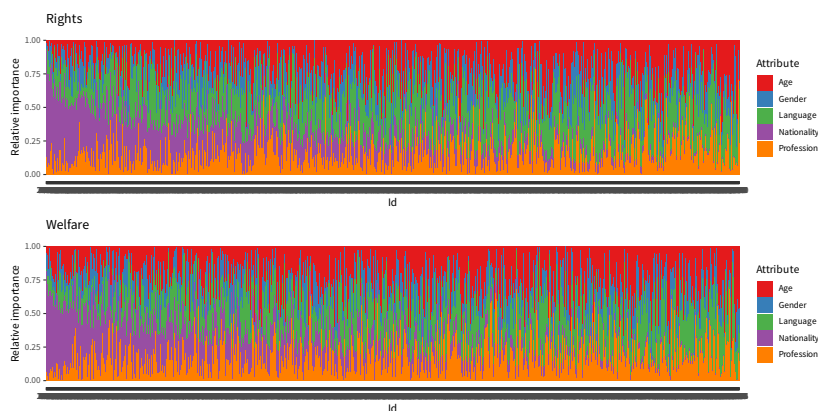


Figure 3.19: Relative importances assigned to each attribute by every individual, by outcome.

```
qtl <- seq(0, 1, by = 0.05)
ri.quantiles <- S.relative.importance %>%
 group_by(Outcome, Attribute, Sample) %>%
 # This summarize() requires dplyr-1.0 as of 200419
 summarize(q = qtl,
 quantiles = quantile(`Relative importance`, qtl))

ggplot(ri.quantiles,
 aes(x = q, y = quantiles, color = Attribute, lty = Sample)) +
 geom_line() +
 facet_grid(~ Outcome) +
 scale_fill_brewer(type = "qual", palette = "Set1") +
 xlab("Individuals (percentile, ordered)") + ylab("Relative importance") +
 ggtitle("Individual Relative importances")
```

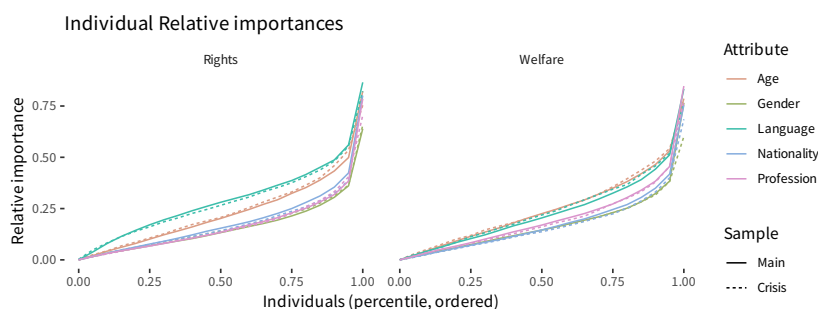


Figure 3.20: Comparison of relative importances for each sample.

```
ggplot(ri.quantiles,
 aes(x = q, y = quantiles, color = Outcome, lty = Sample)) +
 geom_line() +
 facet_grid(~ Attribute) +
 scale_color_discrete_qualitative(palette = "Dark 2") +
 xlab("Individuals (percentile, ordered)") + ylab("Relative importance") +
 ggtitle("Individual Relative importances")

ggplot(ri.quantiles,
 aes(x = q, y = quantiles, color = Sample)) +
 geom_line() +
```

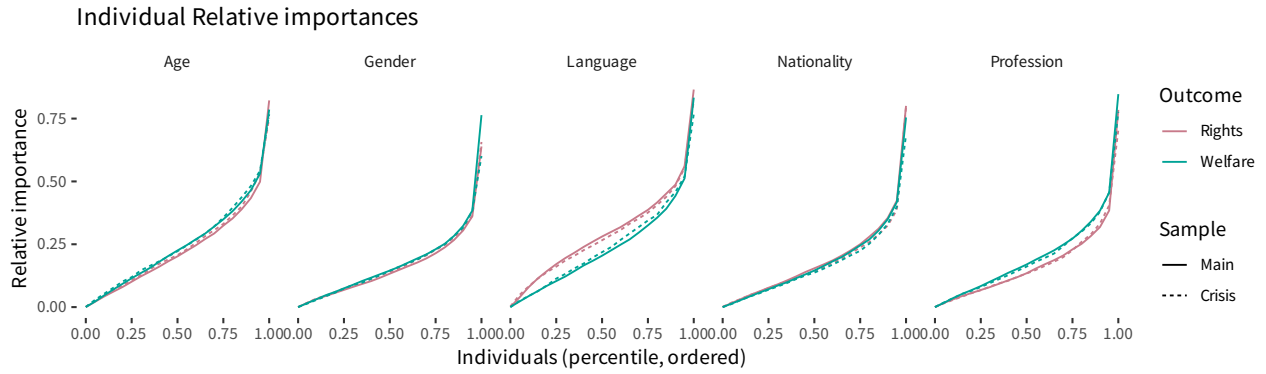


Figure 3.21: Comparison of relative importances for each sample.

```
facet_grid(Outcome ~ Attribute) +
scale_color_discrete_qualitative(palette = "Dark 2") +
xlab("Individuals (percentile, ordered)") + ylab("Relative importance") +
ggtitle("Individual Relative importances")
```

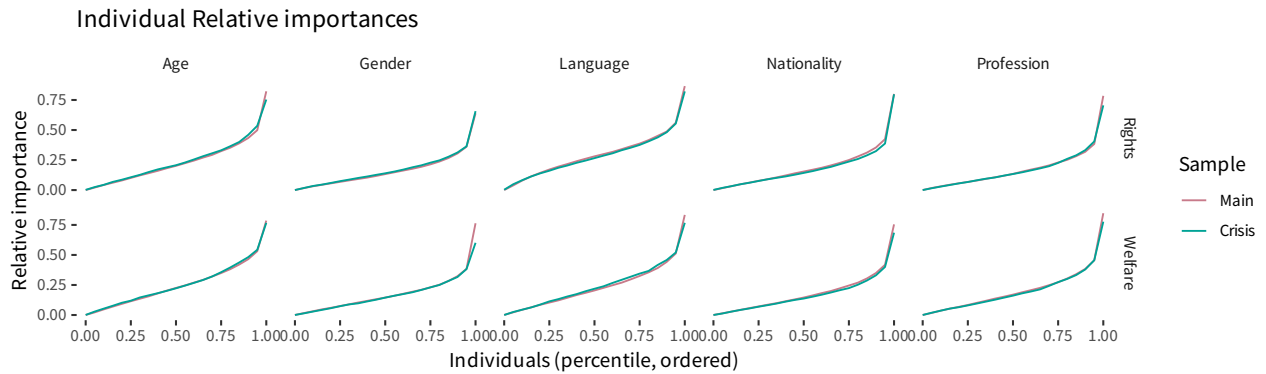


Figure 3.22: Comparison of relative importances for each sample.

```
pairs.S.relative.importance <- S.relative.importance %>%
 ungroup() %>%
 select(id, Outcome, Attribute, `Relative importance`) %>%
 mutate(id = as.numeric(as.character(id))) %>%
 left_join(select(di, id, Sample, Treatment)) %>%
 pivot_wider(names_from = Attribute, values_from = `Relative importance`)

my_dens <- function(data, mapping, ... , low = "#132B43", high = "#56B1F7") {
 ggplot(data = data, mapping=mapping) +
 geom_density(... , alpha=0.3)
}

ggpairs(select(pairs.S.relative.importance, -id),
 lower = list(continuous = wrap("points", alpha = 0.1)),
 diag = list(continuous = my_dens),
 mapping = aes(color = Outcome))
```

### 3.3 Explanatory variables for individual discriminations

```
L.theta <- plab("theta", list(Outcome = outcome.label,
 Feature = feature.label,
 Sample = sample.label,
 Covariate = covariate.label))

S.theta <- ggs(s, family = "^theta\\[", par_labels = L.theta) %>%
 mutate(Model = M) %>%
```

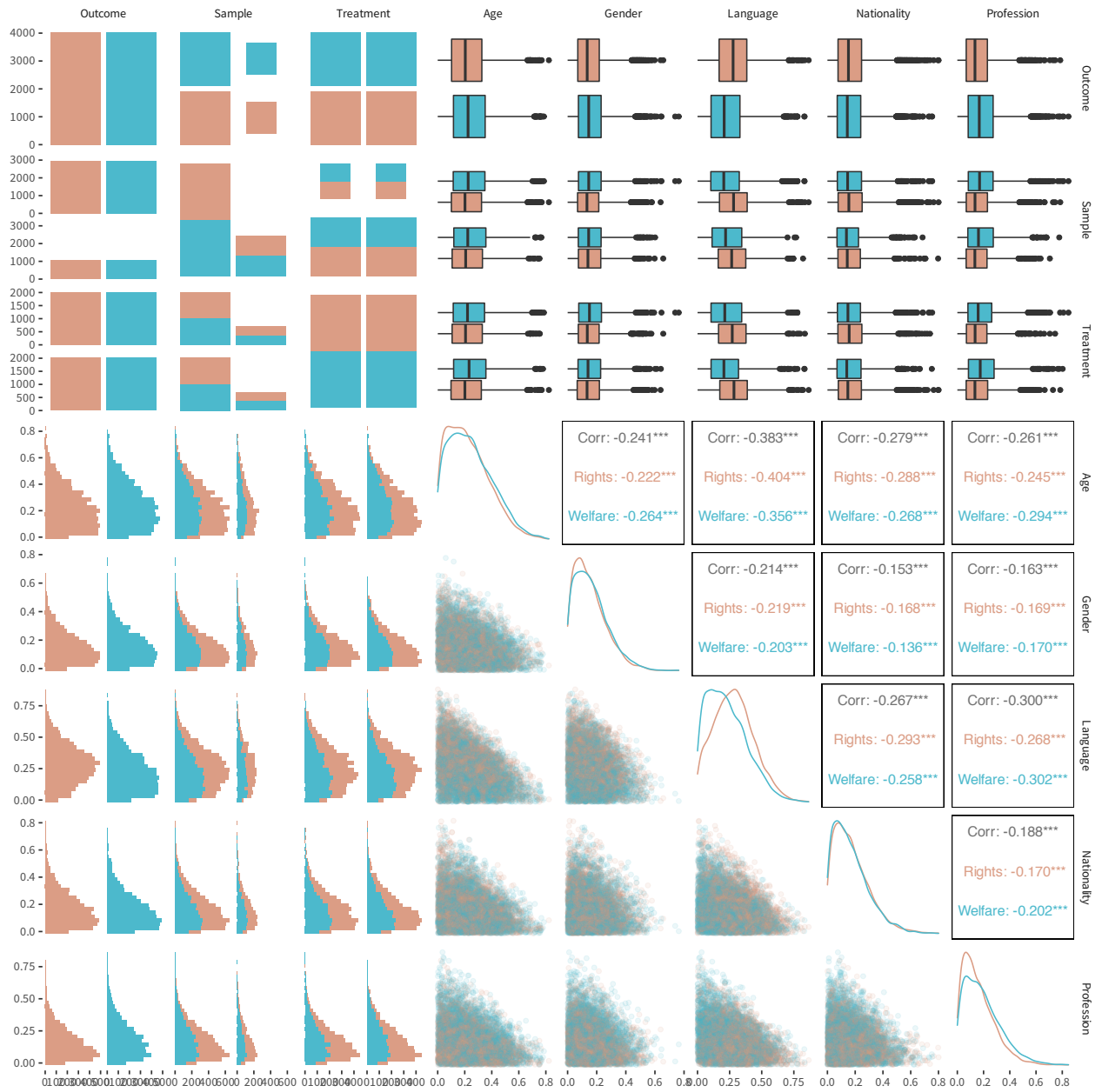


Figure 3.23: Comparison of individual relative importances, by outcome.

```
filter(Feature != "First shown")
save(S.theta, file = paste("samples-", M.lab, "-theta", ".RData", sep = ""))
ci.theta <- ci(S.theta)
```

Figure 3.24 allows to compare the difference in the effects of each sample (main/crisis) for each individual characteristic, by outcome (welfare/rights).

It can be read as follows: the last row of each panel, containing the “(Intercept)” is the baseline effect of prioritizing one individual over another. The two “(Intercept)” effects in the first column represent the reference category which, in both outcomes, is less preferred than other features. If we would observe differences between the two samples in the last two rows, for the features (nationality, gender, profession, language and age), then we would have to conclude that during crisis the overall effect of prioritization would have changed. But this is not happening in any feature, neither for welfare nor for rights. Therefore, we must conclude that the crisis has not altered, overall, the society response to prioritization requests. The population keeps having the same aggregative patterns of discrimination.

On the other hand, if we would found differences in crisis/main sample for the individual effects altering the likelihood of prioritizing, then we would have to conclude that what has changed is how individual characteristics realign the sources of discrimination. For instance, if the intercept (lower row) is positive (implying that this concrete feature is prioritized over the reference category) and an effect that was zero now is positive, this would mean that that specific individual characteristic increases the discrimination during crisis. Likewise, if the main effect (last row) is positive and the individual effect is negative, it would imply that the source of discrimination is lower during crisis, for that specific individual characteristic.

```
ci.theta %>%
 ggplot(aes(ymin = low, ymax = high, y = median,
 x = Covariate,
 group = Sample, color = Sample)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(Outcome ~ Feature, scales = "free") +
 geom_hline(aes(yintercept = 0), lty = 3) +
 xlab("Covariates") +
 scale_color_discrete_qualitative(palette = "Dynamic")

p90relevant <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 group_by(Outcome, Sample, Feature, Covariate) %>%
 summarize(prob = length(which(value > 0)) / n()) %>%
 mutate(relevant = ifelse(prob > 0.9 | prob < 0.1, 1, 0.2))

ci.theta %>%
 left_join(p90relevant) %>%
 ggplot(aes(ymin = low, ymax = high, y = median,
 x = Covariate,
 group = Sample, color = Sample, alpha = relevant)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(Outcome ~ Feature, scales = "free") +
```

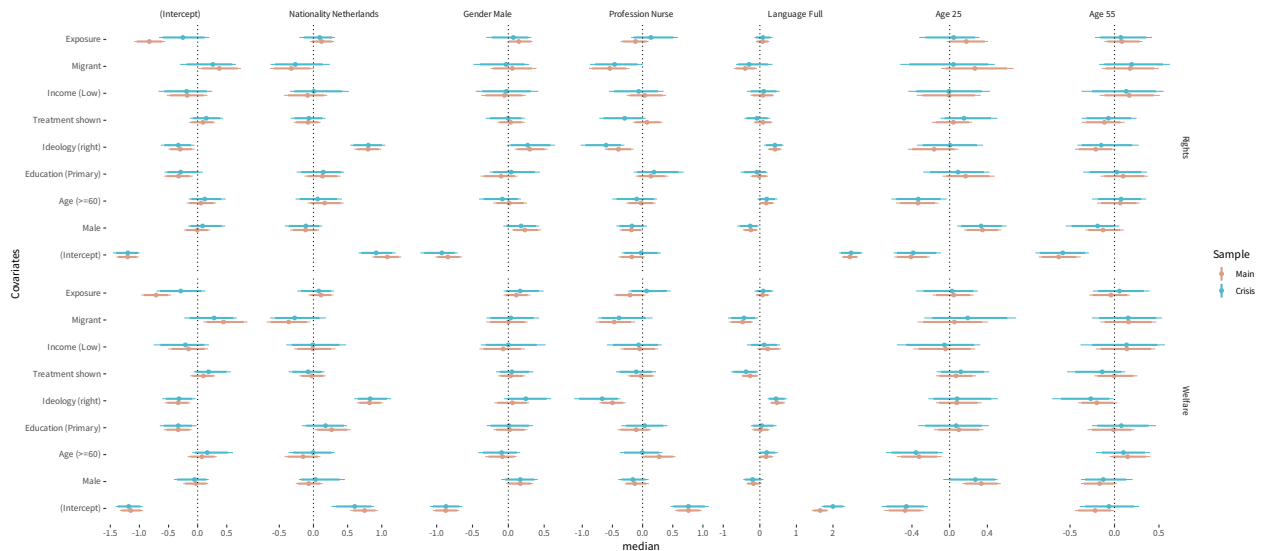


Figure 3.24: Discrimination for each attribute, with its effect by individual covariates, by outcome.

```
geom_hline(aes(yintercept = 0), lty = 3) +
xlab("Covariates") +
guides(alpha = FALSE) +
scale_color_discrete_qualitative(palette = "Dynamic")

comparison.relevant <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 pivot_wider(names_from = Sample, values_from = value) %>%
 group_by(Outcome, Feature, Covariate) %>%
 summarize(prob = length(which(Crisis > Main)) / n()) %>%
 mutate(relevant = ifelse(prob > 0.90 | prob < 0.10, 1, 0.2))

ci.theta %>%
 left_join(comparison.relevant) %>%
 ggplot(aes(ymin = low, ymax = high, y = median,
 x = Covariate,
 group = Sample, color = Sample, alpha = relevant)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(Outcome ~ Feature, scales = "free") +
 geom_hline(aes(yintercept = 0), lty = 3) +
 xlab("Covariates") +
 guides(alpha = FALSE) +
 scale_color_discrete_qualitative(palette = "Dynamic")

ci.theta %>%
 ggplot(aes(ymin = low, ymax = high, y = median,
 x = Feature,
 group = Sample, color = Sample)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(Covariate ~ Outcome, scales = "free") +
 geom_hline(aes(yintercept = 0), lty = 3) +
 xlab("Covariates") +
 scale_color_discrete_qualitative(palette = "Dynamic")
```

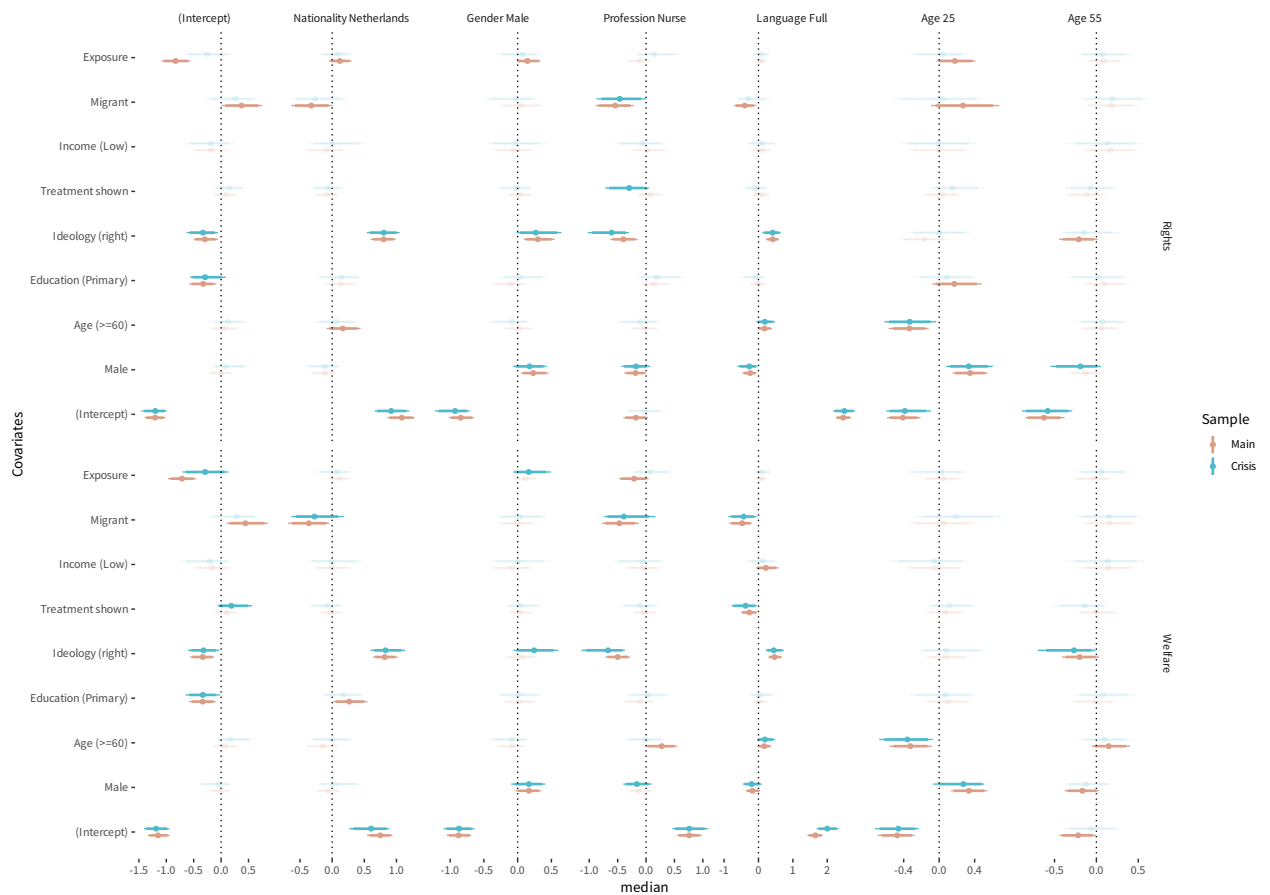


Figure 3.25: Discrimination for each attribute, with its effect by individual covariates, by outcome. Highlighted effects correspond to parameters with density not overlapping zero by 10 percent or more.

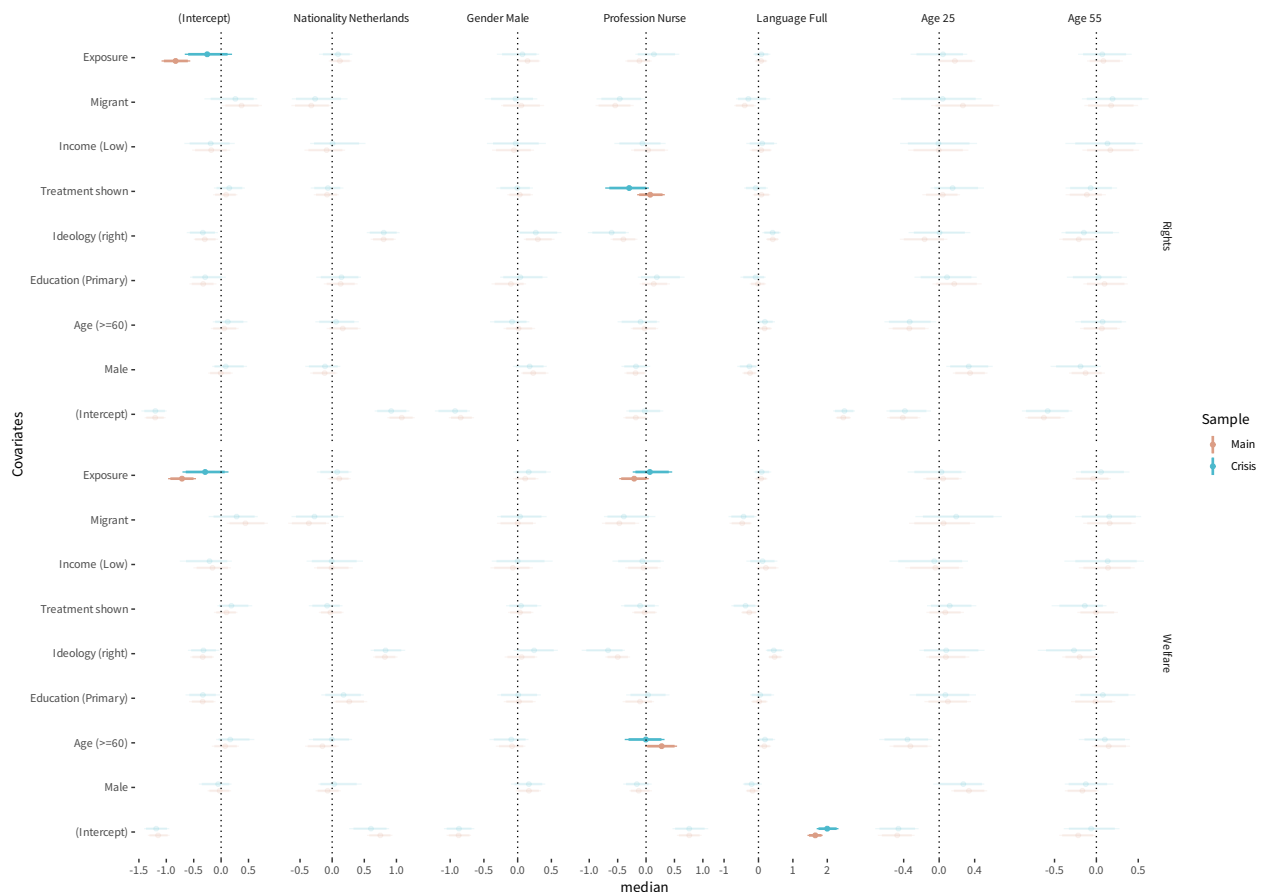


Figure 3.26: Discrimination for each attribute, with its effect by individual covariates, by outcome. The effects highlighted correspond to pre-post covid effects being different with probability higher than 99%.



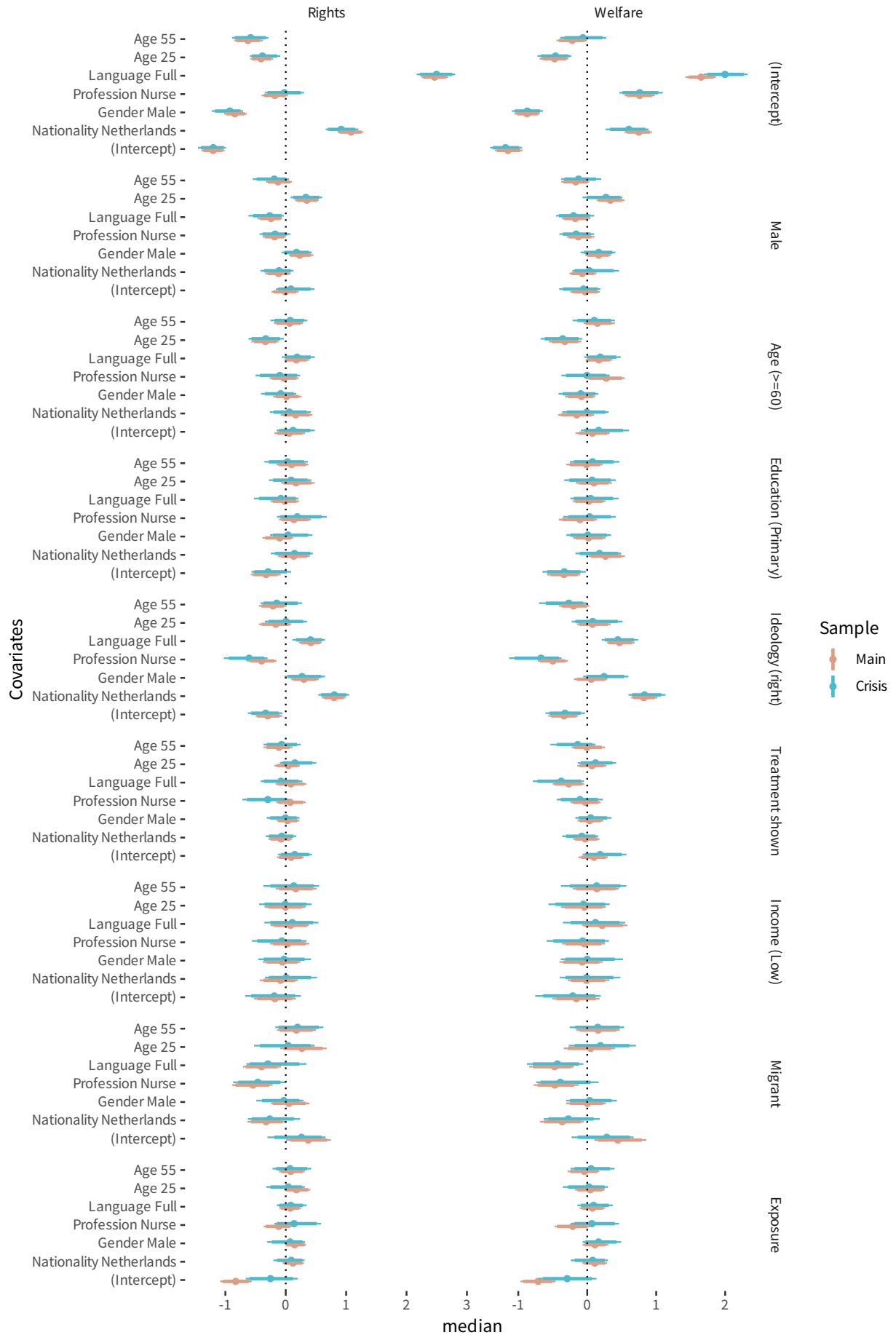


Figure 3.27: Discrimination for each attribute, with its effect by individual covariates, by outcome and sample

```
ci.theta %>%
ggplot(aes(ymin = low, ymax = high, y = median,
 x = Covariate,
 group = Sample, color = Sample)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(Feature ~ Outcome, scales = "free") +
 geom_hline(aes(yintercept = 0), lty = 3) +
 xlab("Covariates") +
 scale_color_discrete_qualitative(palette = "Dynamic")
```

Interpretation of the magnitude of the individual-level effects on the likelihood of preference for different profiles can be seen at ??.

```
pp <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 filter(Feature != "First shown") %>%
 filter(Covariate != "Treatment shown") %>%
 spread(Feature, value) %>%
 gather(Feature, value, -c(Iteration, Chain, Outcome, Sample, Covariate, `(Intercept)`)) %>%
 mutate(`0` = inv.logit(`(Intercept)`)) %>%
 mutate(`1` = inv.logit(`(Intercept)` + value)) %>%
 select(-c(`(Intercept)`, value))
```

```
pp %>%
 filter(Outcome == "Rights") %>%
 sample_frac(0.02) %>%
 filter(Covariate != "(Intercept)") %>%
 ggplot(aes(x = 0, y = `0`,
 xend = 1, yend = `1`,
 color = Sample)) +
 geom_segment(alpha = 0.2) +
 facet_grid(Feature ~ Covariate) +
 xlab("Variable range") + ylab("Predicted probability") +
 ggtitle("Rights") +
 geom_hline(yintercept = 0.5, lty = 3) +
 theme(axis.text.x = element_blank(),
 axis.ticks.x = element_blank()) +
 guides(colour = guide_legend(override.aes = list(alpha = 1))) +
 scale_color_discrete_qualitative(palette = "Dynamic")
```

```
pp <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 filter(Feature != "First shown") %>%
 filter(Covariate != "Treatment shown") %>%
 spread(Feature, value) %>%
 gather(Feature, value, -c(Iteration, Chain, Outcome, Sample, Covariate, `(Intercept)`)) %>%
 mutate(`0` = inv.logit(`(Intercept)`)) %>%
 mutate(`1` = inv.logit(`(Intercept)` + value)) %>%
 select(-c(`(Intercept)`, value))
```

```
pp %>%
 filter(Outcome == "Welfare") %>%
 sample_frac(0.02) %>%
 filter(Covariate != "(Intercept)") %>%
 ggplot(aes(x = 0, y = `0`,
 xend = 1, yend = `1`,
 color = Sample)) +
 geom_segment(alpha = 0.2) +
 facet_grid(Feature ~ Covariate) +
 xlab("Variable range") + ylab("Predicted probability") +
 ggtitle("Welfare") +
 geom_hline(yintercept = 0.5, lty = 3) +
```

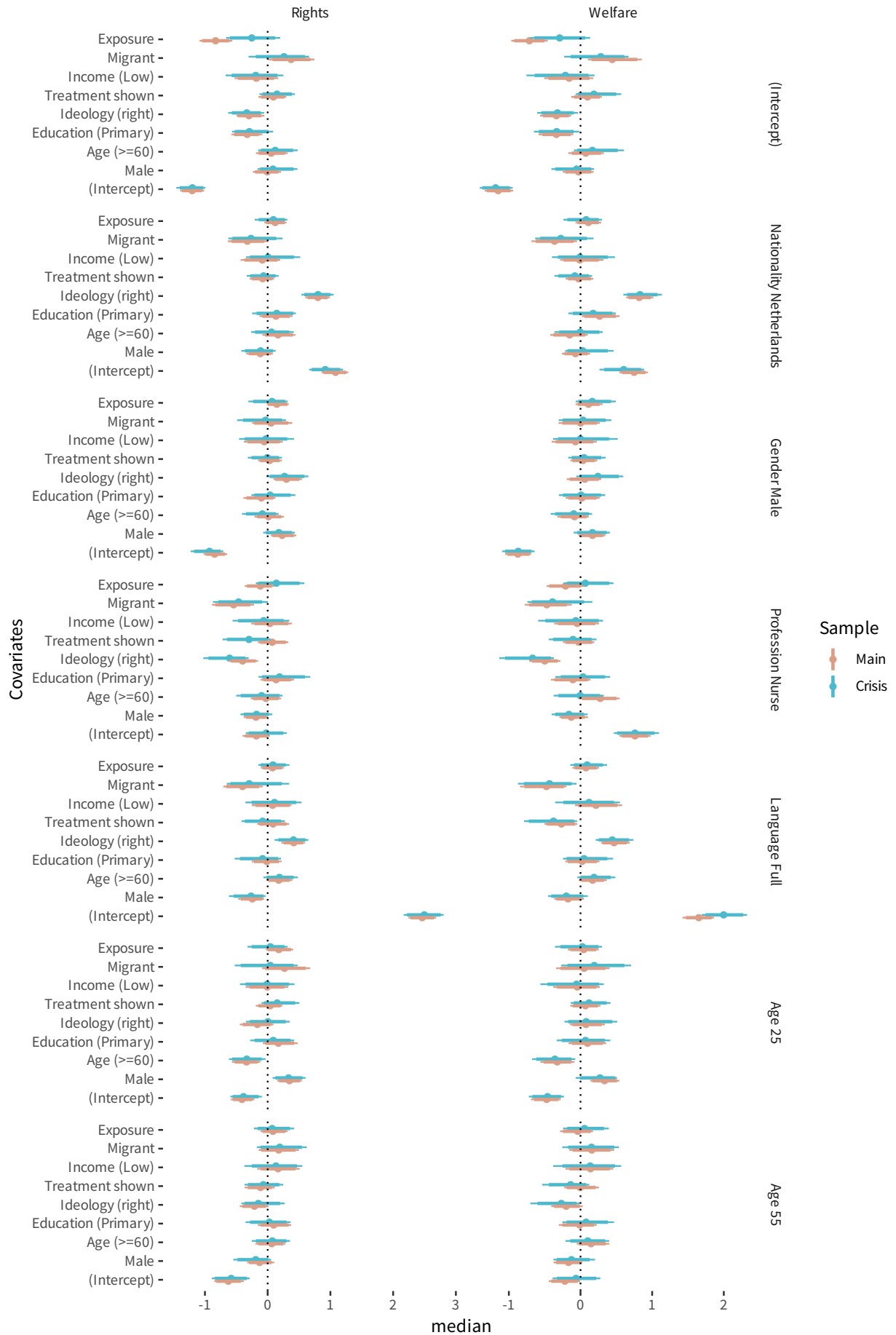


Figure 3.28: Discrimination for each attribute, with its effect by individual covariates, by outcome and sample

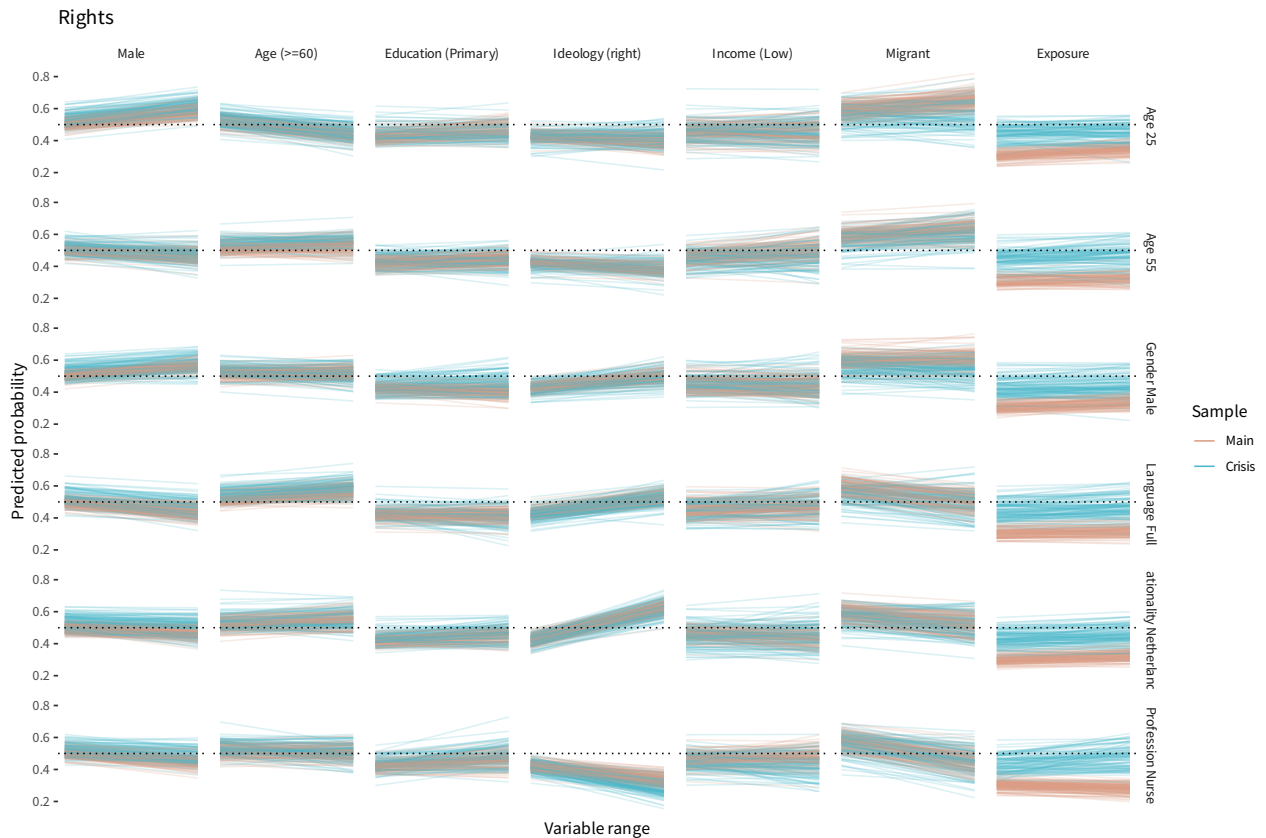


Figure 3.29: Predicted probability of prioritizing any given profile, by the change in each of the individual-level covariates, ranging from their standardized values. Only rights. The figure can be interpreted as follows: the slopes of the graph in the first row, first column are positive, which means that compared to females (low value in the horizontal axis), males (high value in the horizontal axis) have higher preference for younger individuals (because of the positive slopes). For the first row, second column the interpretation is that as age increases, individuals are have lower preferences for younger profiles, indistinctively in the main sample or in the crisis sample.

```
theme(axis.text.x = element_blank(),
 axis.ticks.x = element_blank()) +
guides(colour = guide_legend(override.aes = list(alpha = 1))) +
scale_color_discrete_qualitative(palette = "Dynamic")

pp <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 filter(Feature != "First shown") %>%
 filter(Covariate != "Treatment shown") %>%
 spread(Feature, value) %>%
 gather(Feature, value, -c(Iteration, Chain, Outcome, Sample, Covariate)) %>%
 mutate(`0` = inv.logit(`(Intercept)`) %>%
 mutate(`1` = inv.logit(`(Intercept)` + value)) %>%
 select(-c(`(Intercept)`, value)) %>%
 gather(x, `Predicted probability`, `0`, `1`) %>%
 group_by(Outcome, Sample, Covariate, Feature, x) %>%
 summarize(`Predicted probability` = median(`Predicted probability`)) %>%
 spread(x, `Predicted probability`)

pp %>%
 filter(Outcome = "Rights") %>%
 filter(Covariate != "(Intercept)") %>%
 ggplot(aes(x = 0, y = `0`,
 xend = 1, yend = `1`,
 color = Sample)) +
 geom_segment() +
 facet_grid(Feature ~ Covariate) +
 xlab("Variable range") + ylab("Predicted probability") +
 ggtitle("Rights") +
 geom_hline(yintercept = 0.5, lty = 3) +
 theme(axis.text.x = element_blank(),
```

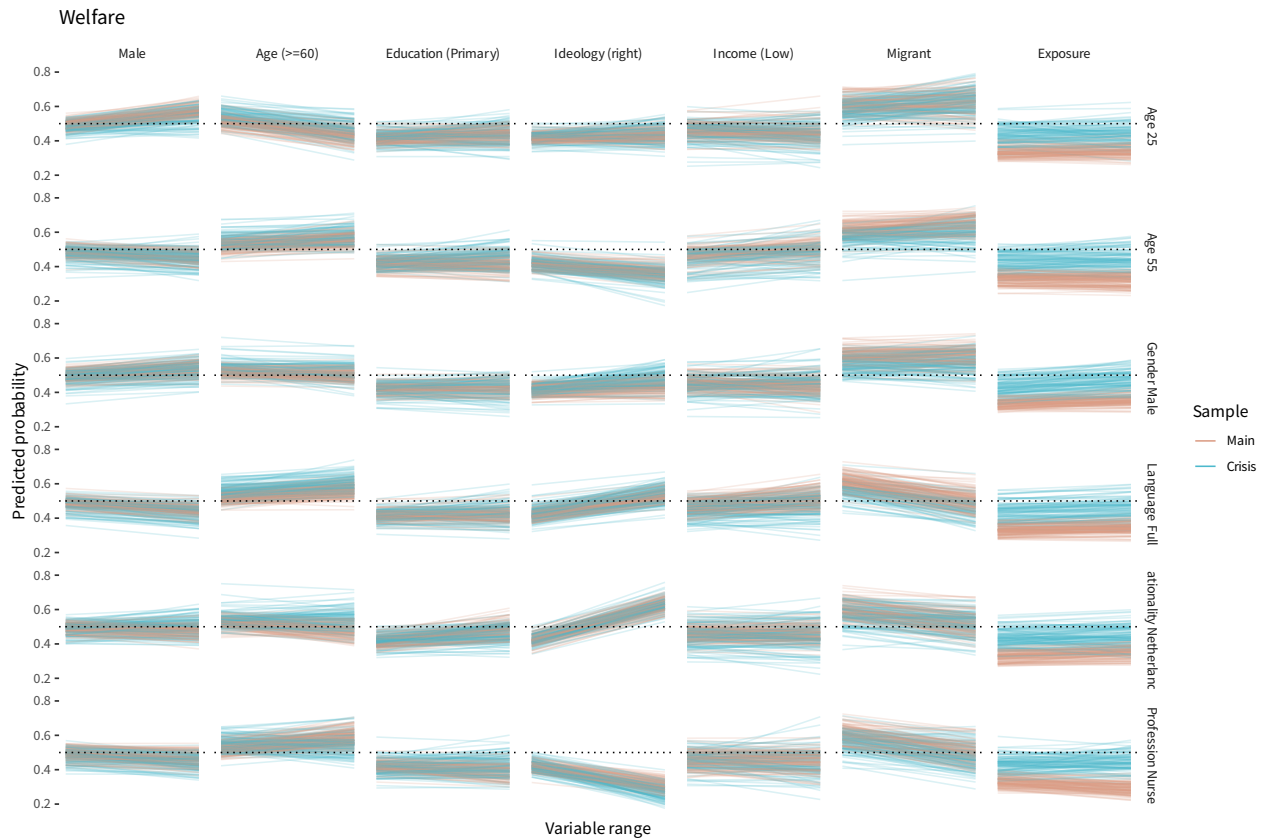


Figure 3.30: Predicted probability of prioritizing any given profile, by the change in each of the individual-level covariates, ranging from their standardized values. Only welfare.

```
axis.ticks.x = element_blank() +
guides(colour = guide_legend(override.aes = list(alpha = 1))) +
scale_color_discrete_qualitative(palette = "Dynamic")

pp <- S.theta %>%
 select(Iteration, Chain, Outcome, Feature, Sample, Covariate, value) %>%
 filter(Feature != "First shown") %>%
 filter(Covariate != "Treatment shown") %>%
 spread(Feature, value) %>%
 gather(Feature, value, -c(Iteration, Chain, Outcome, Sample, Covariate, `(Intercept)`)) %>%
 mutate(`0` = inv.logit `(Intercept)`) %>%
 mutate(`1` = inv.logit `(Intercept)` + value)) %>%
 select(-c `(Intercept)` , value)) %>%
 gather(x, `Predicted probability`, `0`, `1`) %>%
 group_by(Outcome, Sample, Covariate, Feature, x) %>%
 summarize(`Predicted probability` = median(`Predicted probability`)) %>%
 spread(x, `Predicted probability`)

pp %>%
 filter(Outcome = "Welfare") %>%
 filter(Covariate != "(Intercept)") %>%
 ggplot(aes(x = 0, y = `0`,
 xend = 1, yend = `1`,
 color = Sample)) +
 geom_segment() +
 facet_grid(Feature ~ Covariate) +
 xlab("Variable range") + ylab("Predicted probability") +
 ggtitle("Welfare") +
 geom_hline(yintercept = 0.5, lty = 3) +
 theme(axis.text.x = element_blank(),
 axis.ticks.x = element_blank()) +
```

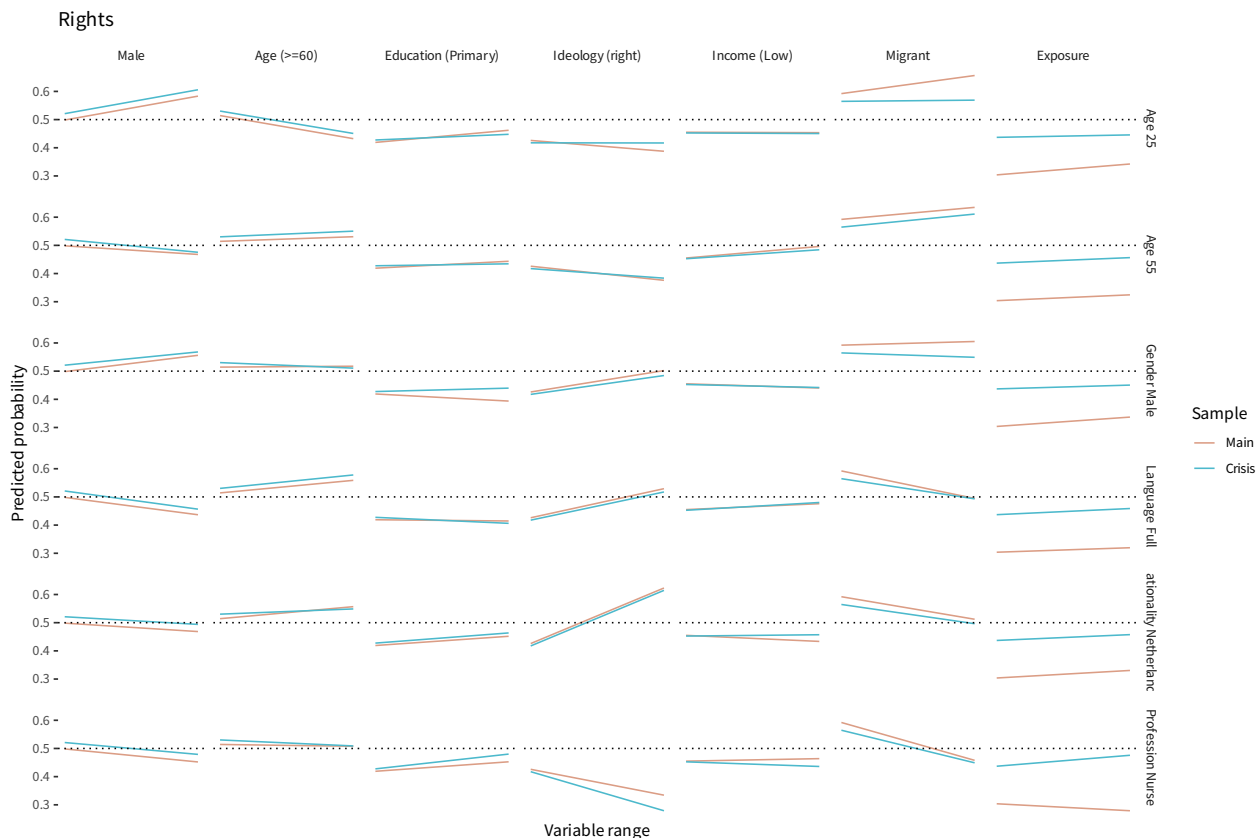


Figure 3.31: Predicted probability of prioritizing any given profile, by the change in each of the individual-level covariates, ranging from their standardized values. Only rights.

```
guides(colour = guide_legend(override.aes = list(alpha = 1))) +
scale_color_discrete_qualitative(palette = "Dynamic")

L.omega <- plab("omega", list(Feature = feature.label,
 Covariate = covariate.label))
S.omega <- ggs(s, family = "^omega\\[", par_labels = L.omega)
ggplot(ci(S.omega), aes(ymin = low, ymax = high,
 y = median, x = Covariate)) +
 coord_flip() +
 geom_point(position = position_dodge(width = 0.3)) +
 geom_linerange(position = position_dodge(width = 0.3)) +
 geom_linerange(aes(ymin = Low, ymax = High), size = 1, position = position_dodge(width = 0.3)) +
 facet_grid(~ Feature) +
 geom_hline(aes(yintercept = 0), lty = 3) +
 xlab("Parameter") + ylab("HPD") +
 ggtitle("Grand-grand-means for prioritization")

List median expected effects, by magnitude.

tb <- S.omega %>%
 filter(Feature != "(Intercept)") %>%
 ci() %>%
 arrange(desc(abs(median))) %>%
 mutate(`Odds Ratio` = exp(median)) %>%
 mutate(`Expected effect` = or(`Odds Ratio`)) %>%
 select(Feature, Covariate, `Odds Ratio`, `Expected effect`)

tc <- "Odds ratio of expected grand-effects, sorted by magnitude."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, longtable = TRUE, booktabs = TRUE) %>%
 kable_styling(font_size = 10)
```

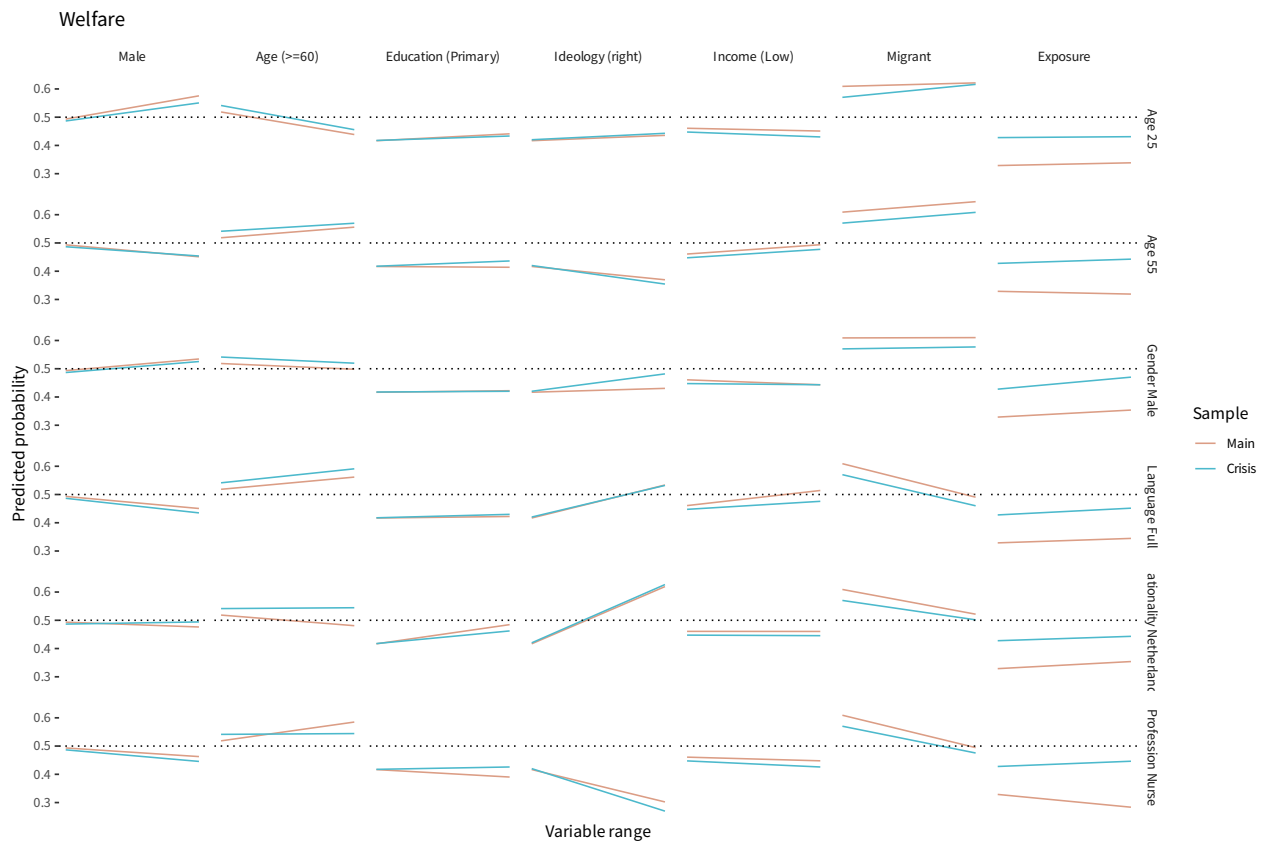


Figure 3.32: Predicted probability of prioritizing any given profile, by the change in each of the individual-level covariates, ranging from their standardized values. Only welfare.

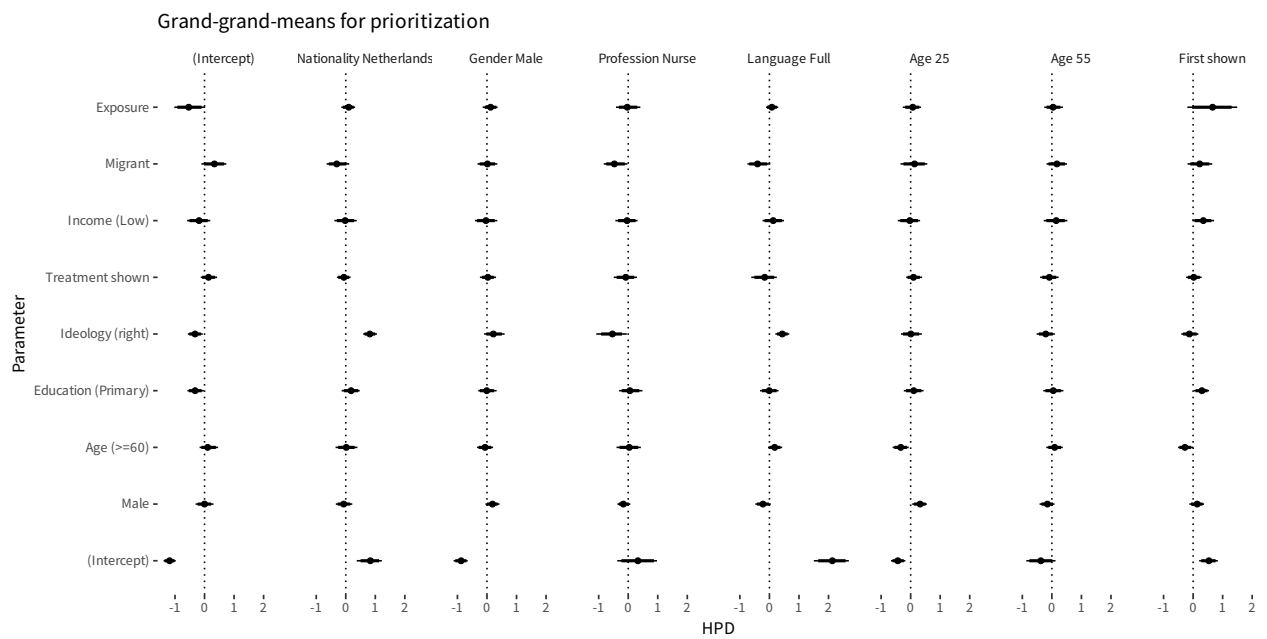


Figure 3.33: Prioritization of features (grand-grand mean).

```

} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10, position = "center", bootstrap_options = "striped", full_width = T)
}

```

Table 3.1: Odds ratio of expected grand-effects, sorted by magnitude.

| Feature                 | Covariate           | Odds Ratio | Expected effect |
|-------------------------|---------------------|------------|-----------------|
| Language Full           | (Intercept)         | 8.4098     | △ 740%          |
| Gender Male             | (Intercept)         | 0.4163     | ▽ 58%           |
| Nationality Netherlands | (Intercept)         | 2.2992     | △ 130%          |
| Nationality Netherlands | Ideology (right)    | 2.2602     | △ 130%          |
| First shown             | Exposure            | 1.9339     | △ 93%           |
| First shown             | (Intercept)         | 1.7083     | △ 71%           |
| Profession Nurse        | Ideology (right)    | 0.5861     | ▽ 41%           |
| Profession Nurse        | Migrant             | 0.6265     | ▽ 37%           |
| Language Full           | Ideology (right)    | 1.5458     | △ 55%           |
| Age 25                  | (Intercept)         | 0.6477     | ▽ 35%           |
| Language Full           | Migrant             | 0.6684     | ▽ 33%           |
| Age 55                  | (Intercept)         | 0.6883     | ▽ 31%           |
| First shown             | Income (Low)        | 1.4122     | △ 41%           |
| Age 25                  | Age (>=60)          | 0.7151     | ▽ 28%           |
| Profession Nurse        | (Intercept)         | 1.3882     | △ 39%           |
| Age 25                  | Male                | 1.3778     | △ 38%           |
| Nationality Netherlands | Migrant             | 0.7373     | ▽ 26%           |
| First shown             | Education (Primary) | 1.3470     | △ 35%           |
| First shown             | Age (>=60)          | 0.7577     | ▽ 24%           |
| First shown             | Migrant             | 1.2487     | △ 25%           |
| Language Full           | Male                | 0.8026     | ▽ 20%           |
| Gender Male             | Ideology (right)    | 1.2414     | △ 24%           |
| Age 55                  | Ideology (right)    | 0.8118     | ▽ 19%           |
| Gender Male             | Male                | 1.2047     | △ 20%           |
| Nationality Netherlands | Education (Primary) | 1.1978     | △ 20%           |
| Language Full           | Age (>=60)          | 1.1959     | △ 20%           |
| Age 55                  | Migrant             | 1.1853     | △ 19%           |
| Profession Nurse        | Male                | 0.8488     | ▽ 15%           |
| Language Full           | Treatment shown     | 0.8511     | ▽ 15%           |
| Age 55                  | Male                | 0.8592     | ▽ 14%           |
| Age 55                  | Income (Low)        | 1.1572     | △ 16%           |
| First shown             | Male                | 1.1492     | △ 15%           |
| Age 25                  | Migrant             | 1.1407     | △ 14%           |
| Language Full           | Income (Low)        | 1.1373     | △ 14%           |
| First shown             | Ideology (right)    | 0.8821     | ▽ 12%           |
| Gender Male             | Exposure            | 1.1300     | △ 13%           |
| Age 25                  | Education (Primary) | 1.1095     | △ 11%           |
| Nationality Netherlands | Exposure            | 1.1051     | △ 11%           |
| Age 25                  | Treatment shown     | 1.1007     | △ 10%           |
| Age 55                  | Age (>=60)          | 1.0999     | △ 10%           |
| Age 55                  | Treatment shown     | 0.9187     | ▽ 8.1%          |
| Profession Nurse        | Treatment shown     | 0.9212     | ▽ 7.9%          |
| Language Full           | Exposure            | 1.0850     | △ 8.5%          |
| Age 25                  | Exposure            | 1.0746     | △ 7.5%          |
| Nationality Netherlands | Male                | 0.9324     | ▽ 6.8%          |



|                         |                     |        |         |
|-------------------------|---------------------|--------|---------|
| Gender Male             | Age (>=60)          | 0.9371 | ▽ 6.3%  |
| Nationality Netherlands | Treatment shown     | 0.9389 | ▽ 6.1%  |
| Profession Nurse        | Education (Primary) | 1.0592 | △ 5.9%  |
| Age 55                  | Education (Primary) | 1.0479 | △ 4.8%  |
| Age 55                  | Exposure            | 1.0416 | △ 4.2%  |
| Profession Nurse        | Income (Low)        | 0.9619 | ▽ 3.8%  |
| Gender Male             | Income (Low)        | 0.9651 | ▽ 3.5%  |
| Profession Nurse        | Age (>=60)          | 1.0362 | △ 3.6%  |
| Profession Nurse        | Exposure            | 0.9682 | ▽ 3.2%  |
| Age 25                  | Income (Low)        | 0.9717 | ▽ 2.8%  |
| Gender Male             | Treatment shown     | 1.0287 | △ 2.9%  |
| First shown             | Treatment shown     | 1.0220 | △ 2.2%  |
| Nationality Netherlands | Income (Low)        | 0.9803 | ▽ 2%    |
| Nationality Netherlands | Age (>=60)          | 1.0168 | △ 1.7%  |
| Gender Male             | Migrant             | 1.0147 | △ 1.5%  |
| Language Full           | Education (Primary) | 0.9917 | ▽ 0.83% |
| Gender Male             | Education (Primary) | 0.9927 | ▽ 0.73% |
| Age 25                  | Ideology (right)    | 1.0059 | △ 0.59% |

### 3.4 Differential discrimination

Figure 3.34 shows the differential discrimination that welfare outcomes have over rights. Histograms show the distribution of the values of the differential discrimination in each simulation. Therefore, a histogram that clearly overlaps 0.5 indicates that there is no trace of differential discrimination. When the histogram barely overlaps zero it indicates evidence of a differential discrimination, either welfare effects being greater than rights (right to the zero) or rights effects being greater than welfare (left to the zero).

```
dd.outcome <- S.theta %>%
 select(Iteration, Chain, Outcome, Covariate, Feature, Sample, value) %>%
 spread(Outcome, value) %>%
 mutate(`Differential discrimination on welfare` = Rights - Welfare)
tb <- dd.outcome %>%
 group_by(Covariate, Feature, Sample) %>%
 summarize(`Prob Welfare > Rights` = length(which(`Differential discrimination on welfare` > 0)) / n()) %>%
 arrange(desc(`Prob Welfare > Rights`))
fig.labels <- tb %>%
 mutate(P = paste0(100 * signif(`Prob Welfare > Rights`, 2), "%")) %>%
 mutate(P = str_replace(P, "^0\\.\"", "\\\"."))
ggplot(filter(dd.outcome, Sample == "Crisis"),
 aes(x = `Differential discrimination on welfare`) +
 geom_histogram(binwidth = 0.01) +
 facet_grid(Covariate ~ Feature) +
 geom_text(data = fig.labels, #filter(fig.labels, Population == "General population"),
 aes(x = -Inf, y = Inf, label = P), size = rel(0.8),
 hjust = -0.5, vjust = +1.5) +
 geom_vline(xintercept = 0, lty = 3) +
 xlim(c(-1, 1)) +
 ggtitle("Differential discrimination on welfare"))

tb <- dd.outcome %>%
 mutate(Covariate = str_replace(Covariate, "\\(", "\\(\\(")) %>%
 group_by(Covariate, Feature) %>%
 summarize(`Prob Welfare > Rights` = length(which(`Differential discrimination on welfare` > 0)) / n()) %>%
 arrange(desc(`Prob Welfare > Rights`))
```

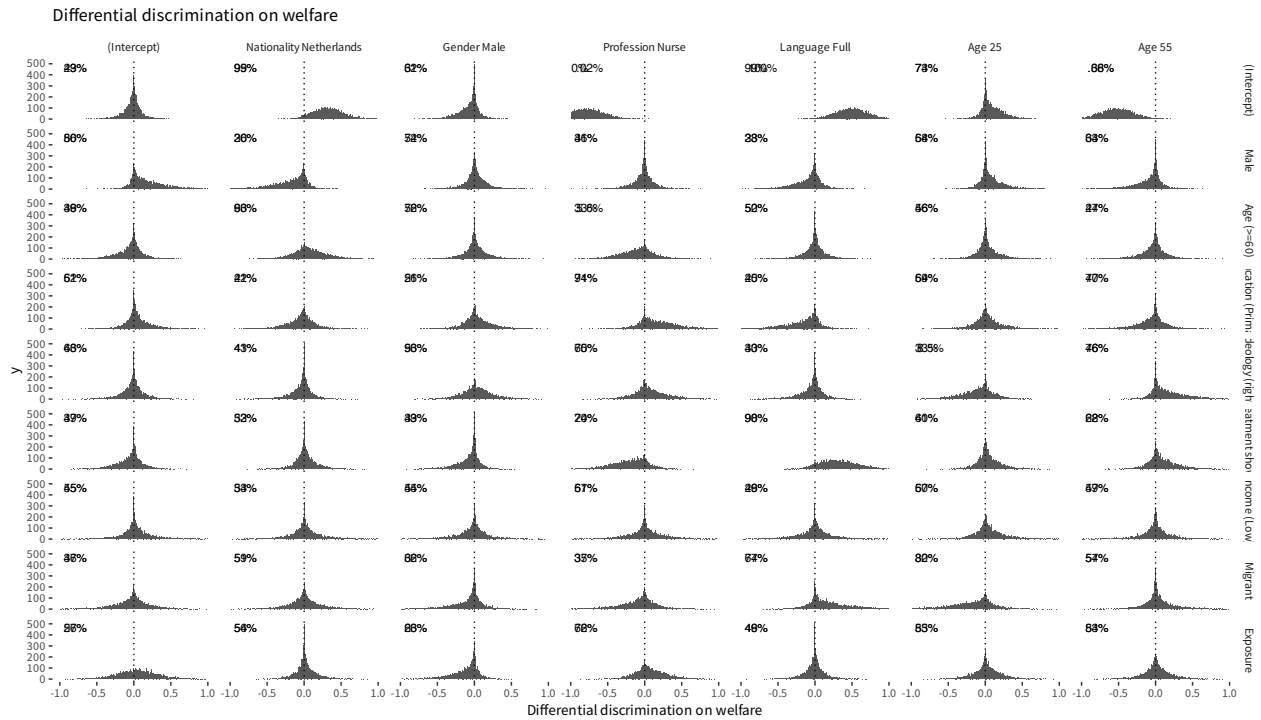


Figure 3.34: Differential discrimination on welfare over rights. Only crisis sample is shown. Values indicate the probability of having found a differential discrimination favouring welfare. %>%

```
tc <- "Probability of finding a differential discrimination on welfare over rights."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, longtable = TRUE, booktabs = TRUE,
 kable_styling(font_size = 8))
} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 8, position = "center", bootstrap_options = "striped", full_width = T)
}
```

Table 3.2: Probability of finding a differential discrimination on welfare over rights.

| Covariate           | Feature                 | Prob Welfare > Rights |
|---------------------|-------------------------|-----------------------|
| \(Intercept)        | Language Full           | 0.9960                |
| \(Intercept)        | Nationality Netherlands | 0.9715                |
| Treatment shown     | Language Full           | 0.9376                |
| Education (Primary) | Profession Nurse        | 0.8243                |
| Age (>=60)          | Nationality Netherlands | 0.7951                |
| Ideology (right)    | Gender Male             | 0.7452                |
| \(Intercept)        | Age 25                  | 0.7327                |
| Migrant             | Language Full           | 0.7086                |
| Exposure            | Age 25                  | 0.6882                |
| Exposure            | Profession Nurse        | 0.6873                |
| Exposure            | Age 55                  | 0.6842                |
| Male                | (Intercept)             | 0.6824                |
| Ideology (right)    | Profession Nurse        | 0.6751                |
| Age (>=60)          | Gender Male             | 0.6388                |
| Male                | Gender Male             | 0.6266                |
| Education (Primary) | Age 25                  | 0.6134                |
| Ideology (right)    | Age 55                  | 0.6110                |
| Male                | Age 25                  | 0.6097                |
| Income (Low)        | Profession Nurse        | 0.5903                |
| Income (Low)        | Age 25                  | 0.5858                |
| Education (Primary) | Age 55                  | 0.5813                |
| Education (Primary) | (Intercept)             | 0.5665                |

|                     |                         |        |
|---------------------|-------------------------|--------|
| Migrant             | Age 25                  | 0.5612 |
| Migrant             | Age 55                  | 0.5563 |
| Migrant             | Nationality Netherlands | 0.5535 |
| Exposure            | Nationality Netherlands | 0.5489 |
| Ideology (right)    | (Intercept)             | 0.5467 |
| Income (Low)        | Age 55                  | 0.5302 |
| Age (>=60)          | Age 25                  | 0.5108 |
| Age (>=60)          | Language Full           | 0.5057 |
| Treatment shown     | Age 25                  | 0.5032 |
| Income (Low)        | (Intercept)             | 0.5027 |
| Income (Low)        | Gender Male             | 0.4965 |
| Migrant             | Gender Male             | 0.4917 |
| Male                | Age 55                  | 0.4862 |
| Exposure            | Language Full           | 0.4790 |
| Treatment shown     | Profession Nurse        | 0.4734 |
| \(Intercept)        | Gender Male             | 0.4658 |
| Treatment shown     | Age 55                  | 0.4471 |
| Exposure            | Gender Male             | 0.4467 |
| Income (Low)        | Nationality Netherlands | 0.4331 |
| Treatment shown     | (Intercept)             | 0.4324 |
| Treatment shown     | Nationality Netherlands | 0.4275 |
| Age (>=60)          | (Intercept)             | 0.4235 |
| Ideology (right)    | Nationality Netherlands | 0.4174 |
| Exposure            | (Intercept)             | 0.4160 |
| Migrant             | (Intercept)             | 0.4158 |
| Treatment shown     | Gender Male             | 0.4123 |
| Education (Primary) | Gender Male             | 0.3868 |
| Male                | Profession Nurse        | 0.3820 |
| Income (Low)        | Language Full           | 0.3744 |
| Ideology (right)    | Language Full           | 0.3689 |
| \(Intercept)        | (Intercept)             | 0.3616 |
| Migrant             | Profession Nurse        | 0.3583 |
| Age (>=60)          | Age 55                  | 0.3540 |
| Education (Primary) | Language Full           | 0.3268 |
| Education (Primary) | Nationality Netherlands | 0.3142 |
| Male                | Language Full           | 0.3022 |
| Male                | Nationality Netherlands | 0.2760 |
| Ideology (right)    | Age 25                  | 0.2085 |
| Age (>=60)          | Profession Nurse        | 0.1917 |
| \(Intercept)        | Age 55                  | 0.0052 |
| \(Intercept)        | Profession Nurse        | 0.0001 |

```
dd.sample <- S.theta %>%
 select(Iteration, Chain, Outcome, Covariate, Feature, Sample, value) %>%
 spread(Sample, value) %>%
 mutate(`Differential discrimination on crisis` = Crisis - Main)
tb <- dd.sample %>%
 group_by(Covariate, Feature, Outcome) %>%
 summarize(`Prob Crisis > Main` = length(which(`Differential discrimination on crisis` < 0)) / n()) %>%
 arrange(desc(`Prob Crisis > Main`))

fig.labels <- tb %>%
 mutate(P = paste0(100 * signif(`Prob Crisis > Main`, 2), "%")) %>%
 mutate(P = str_replace(P, "^0\\.\"", "\\.\"")) %>%
 mutate(HighlightP = ifelse(abs(`Prob Crisis > Main` - 0.5) > 0.45, "Highlight", "Plain"))

fig.labels.Xpercent <- dd.sample %>%
 group_by(Covariate, Feature, Outcome) %>%
 summarize(`Prob Crisis > Main Xpercent` = length(which(`Differential discrimination on crisis` > log(1.05)
 `Prob Crisis < Main Xpercent` = length(which(`Differential discrimination on crisis` < -log(1.05)
 mutate(P.pos = `Prob Crisis > Main Xpercent`) %>%
 mutate(P.neg = `Prob Crisis < Main Xpercent`) %>%
 mutate(P = ifelse(P.pos > P.neg, P.pos, P.neg)) %>%
 mutate(HighlightP = ifelse(abs(P - 0.5) > 0.45, "Highlight", "Plain")) %>%
 mutate(P.pos = str_replace(paste0(100 * signif(P.pos, 2), "%"), "^0\\.\"", "\\.\"")) %>%
```

```
mutate(P.neg = str_replace(paste0(100 * signif(P.neg, 2), "%"), "^\\.\"", "\\\"")) %>%
mutate(P = str_replace(paste0(100 * signif(P, 2), "%"), "^0\\.", "\\."))

tb <- dd.sample %>%
 mutate(Covariate = str_replace(Covariate, "\\(", "\\\\(")) %>%
 group_by(Outcome, Covariate, Feature) %>%
 summarize(`Prob Crisis > Main` = length(which(`Differential discrimination on crisis` < 0)) / n()) %>%
 arrange(desc(`Prob Crisis > Main`))

tc <- "Probability of finding a differential discrimination on crisis over regular period."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, longtable = TRUE, booktabs = TRUE) %>%
 kable_styling(font_size = 8)
} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 8, position = "center", bootstrap_options = "striped", full_width = T)
}
```

Table 3.3: Probability of finding a differential discrimination on crisis over regular period.

| Outcome | Covariate           | Feature                 | Prob Crisis > Main |
|---------|---------------------|-------------------------|--------------------|
| Rights  | Treatment shown     | Profession Nurse        | 0.9520             |
| Welfare | Age (>=60)          | Profession Nurse        | 0.9004             |
| Rights  | Ideology (right)    | Profession Nurse        | 0.8674             |
| Rights  | \(Intercept)        | Nationality Netherlands | 0.8532             |
| Welfare | Ideology (right)    | Profession Nurse        | 0.8174             |
| Welfare | Treatment shown     | Age 55                  | 0.8092             |
| Rights  | Migrant             | Age 25                  | 0.8086             |
| Welfare | \(Intercept)        | Nationality Netherlands | 0.8078             |
| Rights  | Treatment shown     | Language Full           | 0.8064             |
| Rights  | Exposure            | Age 25                  | 0.7924             |
| Rights  | \(Intercept)        | Gender Male             | 0.7754             |
| Welfare | Migrant             | (Intercept)             | 0.7572             |
| Rights  | Age (>=60)          | Gender Male             | 0.7390             |
| Rights  | Exposure            | Gender Male             | 0.7278             |
| Welfare | Treatment shown     | Language Full           | 0.7142             |
| Rights  | Age (>=60)          | Nationality Netherlands | 0.7116             |
| Rights  | Education (Primary) | Age 25                  | 0.6948             |
| Rights  | Migrant             | (Intercept)             | 0.6904             |
| Rights  | Male                | Age 55                  | 0.6870             |
| Welfare | Education (Primary) | Nationality Netherlands | 0.6866             |
| Welfare | Ideology (right)    | Age 55                  | 0.6854             |
| Welfare | Male                | Age 25                  | 0.6806             |
| Rights  | Income (Low)        | Profession Nurse        | 0.6750             |
| Rights  | Migrant             | Gender Male             | 0.6708             |
| Rights  | Male                | Gender Male             | 0.6666             |
| Welfare | Income (Low)        | Language Full           | 0.6630             |
| Welfare | Treatment shown     | Nationality Netherlands | 0.6622             |
| Rights  | Education (Primary) | Age 55                  | 0.6598             |
| Rights  | Education (Primary) | Language Full           | 0.6592             |
| Welfare | Treatment shown     | Profession Nurse        | 0.6580             |
| Rights  | Age (>=60)          | Profession Nurse        | 0.6510             |
| Rights  | Treatment shown     | Gender Male             | 0.6236             |
| Welfare | \(Intercept)        | (Intercept)             | 0.6218             |
| Welfare | Age (>=60)          | Age 55                  | 0.6186             |
| Welfare | Exposure            | Nationality Netherlands | 0.6180             |
| Rights  | Exposure            | Nationality Netherlands | 0.6140             |
| Welfare | Income (Low)        | (Intercept)             | 0.6042             |
| Rights  | Ideology (right)    | (Intercept)             | 0.6018             |
| Welfare | Male                | Profession Nurse        | 0.6016             |
| Welfare | Male                | (Intercept)             | 0.5946             |
| Welfare | Age (>=60)          | Age 25                  | 0.5842             |
| Welfare | Male                | Language Full           | 0.5755             |

|         |                     |                         |        |
|---------|---------------------|-------------------------|--------|
| Rights  | Male                | Language Full           | 0.5696 |
| Rights  | Income (Low)        | Age 55                  | 0.5654 |
| Welfare | Exposure            | Age 25                  | 0.5634 |
| Welfare | Education (Primary) | Age 25                  | 0.5612 |
| Welfare | Ideology (right)    | Language Full           | 0.5576 |
| Rights  | Ideology (right)    | Gender Male             | 0.5562 |
| Welfare | Income (Low)        | Profession Nurse        | 0.5506 |
| Welfare | Income (Low)        | Age 25                  | 0.5372 |
| Rights  | Male                | Age 25                  | 0.5310 |
| Rights  | Exposure            | Age 55                  | 0.5278 |
| Welfare | Age (>=60)          | Gender Male             | 0.5266 |
| Welfare | Education (Primary) | Gender Male             | 0.5252 |
| Rights  | Ideology (right)    | Language Full           | 0.5160 |
| Welfare | Income (Low)        | Age 55                  | 0.5154 |
| Rights  | Income (Low)        | (Intercept)             | 0.5070 |
| Welfare | Migrant             | Age 55                  | 0.5042 |
| Rights  | Income (Low)        | Age 25                  | 0.5028 |
| Welfare | \(Intercept)        | Profession Nurse        | 0.5012 |
| Welfare | Education (Primary) | (Intercept)             | 0.4996 |
| Welfare | Income (Low)        | Nationality Netherlands | 0.4972 |
| Rights  | Male                | Nationality Netherlands | 0.4950 |
| Welfare | Male                | Gender Male             | 0.4936 |
| Rights  | Ideology (right)    | Nationality Netherlands | 0.4924 |
| Rights  | Education (Primary) | Nationality Netherlands | 0.4912 |
| Welfare | \(Intercept)        | Gender Male             | 0.4868 |
| Rights  | Age (>=60)          | Age 25                  | 0.4856 |
| Rights  | \(Intercept)        | (Intercept)             | 0.4854 |
| Rights  | Male                | Profession Nurse        | 0.4766 |
| Rights  | Age (>=60)          | Age 55                  | 0.4724 |
| Rights  | Migrant             | Age 55                  | 0.4714 |
| Rights  | Exposure            | Language Full           | 0.4654 |
| Rights  | Age (>=60)          | Language Full           | 0.4618 |
| Welfare | Ideology (right)    | Age 25                  | 0.4612 |
| Welfare | Ideology (right)    | Nationality Netherlands | 0.4590 |
| Rights  | Treatment shown     | Nationality Netherlands | 0.4556 |
| Welfare | Ideology (right)    | (Intercept)             | 0.4538 |
| Rights  | Income (Low)        | Language Full           | 0.4532 |
| Rights  | Income (Low)        | Gender Male             | 0.4524 |
| Welfare | Age (>=60)          | Language Full           | 0.4438 |
| Welfare | \(Intercept)        | Age 25                  | 0.4402 |
| Welfare | Treatment shown     | Gender Male             | 0.4382 |
| Welfare | Migrant             | Language Full           | 0.4342 |
| Welfare | Exposure            | Language Full           | 0.4320 |
| Welfare | Education (Primary) | Language Full           | 0.4308 |
| Rights  | \(Intercept)        | Language Full           | 0.4292 |
| Welfare | Migrant             | Gender Male             | 0.4186 |
| Rights  | \(Intercept)        | Age 25                  | 0.4062 |
| Rights  | \(Intercept)        | Age 55                  | 0.4012 |
| Rights  | Education (Primary) | (Intercept)             | 0.4006 |
| Rights  | Migrant             | Nationality Netherlands | 0.3944 |
| Rights  | Treatment shown     | Age 55                  | 0.3854 |
| Rights  | Education (Primary) | Profession Nurse        | 0.3830 |
| Welfare | Male                | Age 55                  | 0.3750 |
| Welfare | Income (Low)        | Gender Male             | 0.3692 |
| Welfare | Treatment shown     | Age 25                  | 0.3606 |
| Welfare | Exposure            | Gender Male             | 0.3496 |
| Rights  | Treatment shown     | (Intercept)             | 0.3474 |
| Rights  | Migrant             | Profession Nurse        | 0.3472 |
| Welfare | Migrant             | Nationality Netherlands | 0.3412 |
| Welfare | Migrant             | Profession Nurse        | 0.3358 |
| Rights  | Ideology (right)    | Age 55                  | 0.3314 |
| Rights  | Age (>=60)          | (Intercept)             | 0.3214 |

|         |                     |                         |        |
|---------|---------------------|-------------------------|--------|
| Rights  | Income (Low)        | Nationality Netherlands | 0.3180 |
| Welfare | Education (Primary) | Age 55                  | 0.3064 |
| Rights  | Migrant             | Language Full           | 0.2998 |
| Welfare | Migrant             | Age 25                  | 0.2934 |
| Welfare | Age (>=60)          | (Intercept)             | 0.2744 |
| Welfare | Exposure            | Age 55                  | 0.2672 |
| Welfare | Treatment shown     | (Intercept)             | 0.2654 |
| Rights  | Male                | (Intercept)             | 0.2548 |
| Welfare | Male                | Nationality Netherlands | 0.2428 |
| Welfare | Education (Primary) | Profession Nurse        | 0.2388 |
| Welfare | Age (>=60)          | Nationality Netherlands | 0.2216 |
| Rights  | Treatment shown     | Age 25                  | 0.2128 |
| Rights  | Education (Primary) | Gender Male             | 0.2120 |
| Rights  | \(Intercept)        | Profession Nurse        | 0.2096 |
| Rights  | Ideology (right)    | Age 25                  | 0.1968 |
| Welfare | \(Intercept)        | Age 55                  | 0.1850 |
| Welfare | Ideology (right)    | Gender Male             | 0.1522 |
| Rights  | Exposure            | Profession Nurse        | 0.1132 |
| Welfare | Exposure            | Profession Nurse        | 0.0910 |
| Welfare | Exposure            | (Intercept)             | 0.0376 |
| Welfare | \(Intercept)        | Language Full           | 0.0244 |
| Rights  | Exposure            | (Intercept)             | 0.0124 |

```
dd.sample %>%
 filter(Outcome = "Welfare") %>%
 left_join(fig.labels) %>%
 mutate(Highlight = abs(`Prob Crisis > Main` - 0.5)) %>%
ggplot(aes(x = `Differential discrimination on crisis`) +
 geom_histogram(binwidth = 0.01, aes(color = Highlight)) +
 facet_grid(Covariate ~ Feature) +
 geom_text(data = filter(fig.labels, Outcome = "Welfare"),
 aes(x = -Inf, y = Inf, label = P),
 size = rel(0.8),
 hjust = -0.5, vjust = +1.5) +
 geom_vline(xintercept = 0, lty = 3) +
 xlim(c(-1.5, 1.5)) +
 ggtitle("Differential discrimination on crisis. Welfare") +
 scale_color_continuous_sequential(palette = "Grays") +
 theme(strip.text.y = element_text(angle = 0)) +
 guides(color = FALSE)

dd.sample %>%
 filter(Outcome = "Rights") %>%
 left_join(fig.labels) %>%
 mutate(Highlight = abs(`Prob Crisis > Main` - 0.5)) %>%
ggplot(aes(x = `Differential discrimination on crisis`) +
 geom_histogram(binwidth = 0.01, aes(color = Highlight)) +
 facet_grid(Covariate ~ Feature) +
 geom_text(data = filter(fig.labels, Outcome = "Rights"),
 aes(x = -Inf, y = Inf, label = P),
 size = rel(0.8),
 hjust = -0.5, vjust = +1.5) +
 geom_vline(xintercept = 0, lty = 3) +
 xlim(c(-1.5, 1.5)) +
 ggtitle("Differential discrimination on crisis. Rights") +
 scale_color_continuous_sequential(palette = "Grays") +
 theme(strip.text.y = element_text(angle = 0)) +
 guides(color = FALSE)

dd.sample %>%
 filter(Outcome = "Welfare") %>%
 left_join(fig.labels.Xpercent) %>%
 mutate(Highlight = ifelse(HighlightP == "Highlight", 0.9, 0.1)) %>%
```

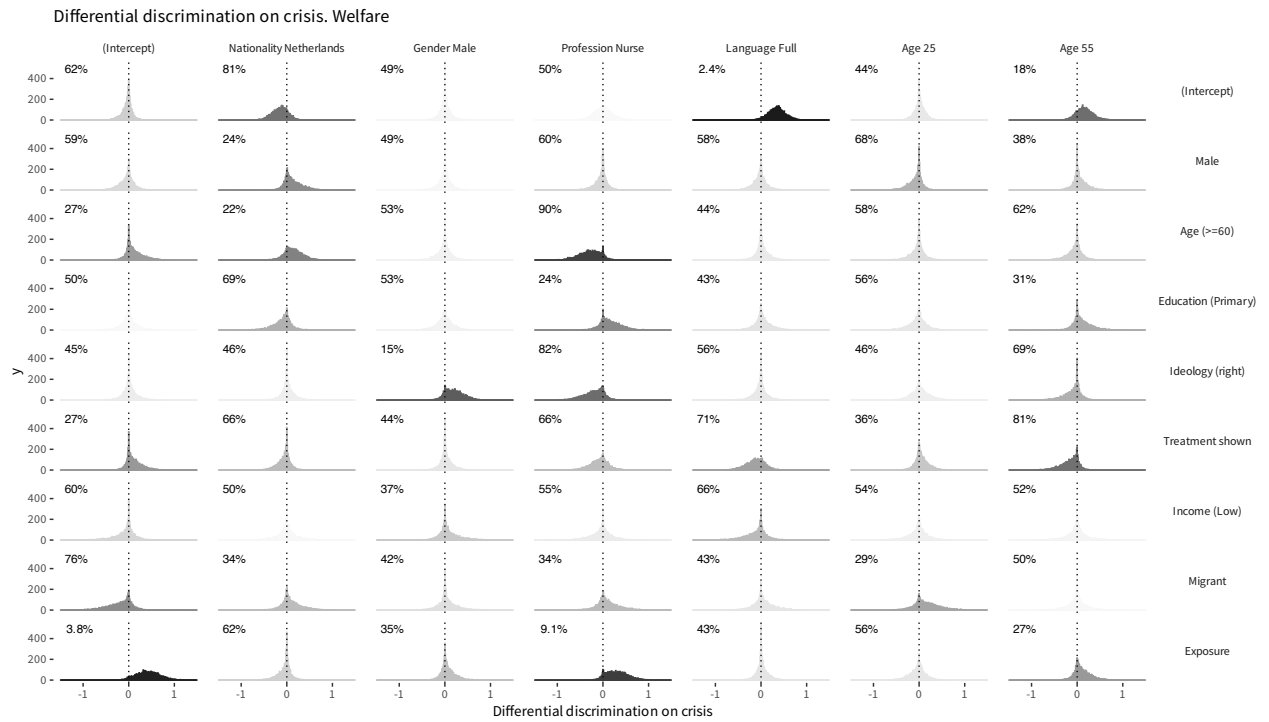


Figure 3.35: Differential discrimination on crisis time over the regular main sample. Only welfare is shown. Values indicate the probability of having found a differential discrimination stronger in crisis.

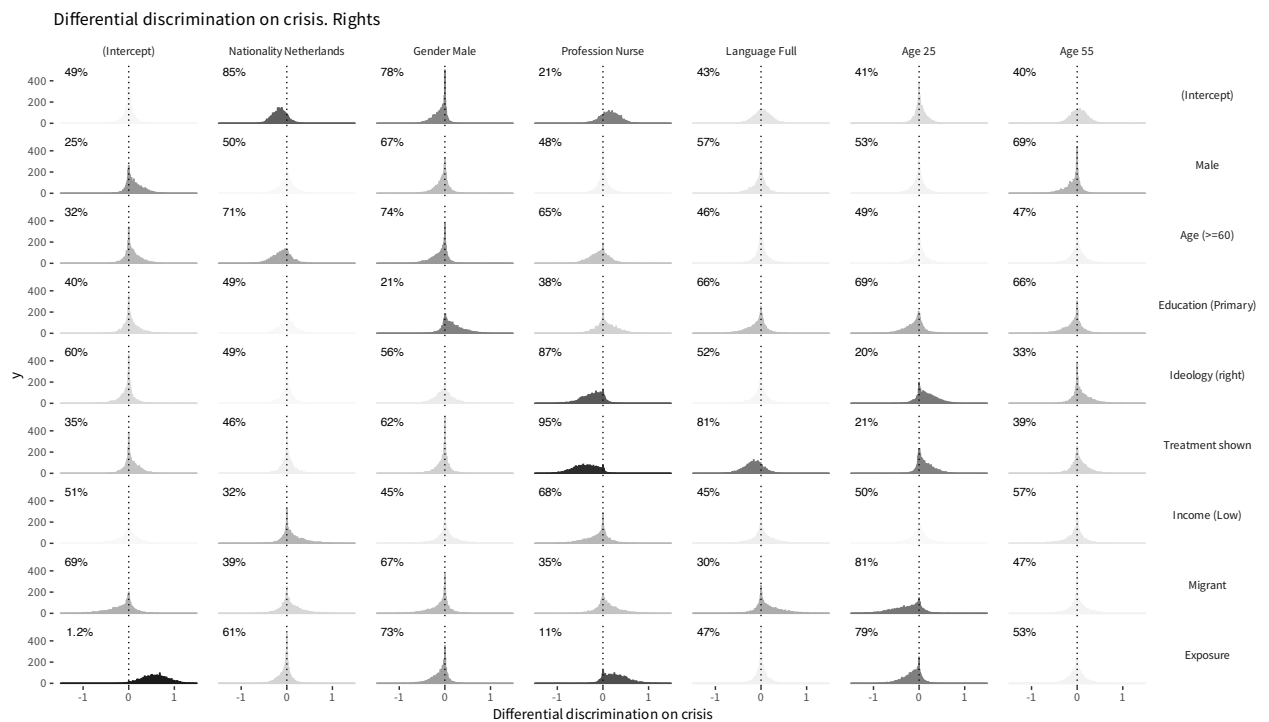


Figure 3.36: Differential discrimination on crisis time over the regular main sample. Only rights is shown. Values indicate the probability of having found a differential discrimination stronger in crisis.

```
ggplot(aes(x = `Differential discrimination on crisis`)) +
 geom_histogram(binwidth = 0.01, aes(color = Highlight)) +
 facet_grid(Covariate ~ Feature) +
 geom_text(data = filter(fig.labels, Outcome = "Welfare"),
 aes(x = -Inf, y = Inf, label = P),
 size = rel(0.8),
 hjust = -0.5, vjust = +1.5) +
 geom_vline(xintercept = 0, lty = 3) +
 xlim(c(-1.5, 1.5)) +
 ggtitle("Differential discrimination on crisis > 5%. Welfare") +
 scale_color_continuous_sequential(palette = "Grays") +
 theme(strip.text.y = element_text(angle = 0)) +
 guides(color = FALSE)
```

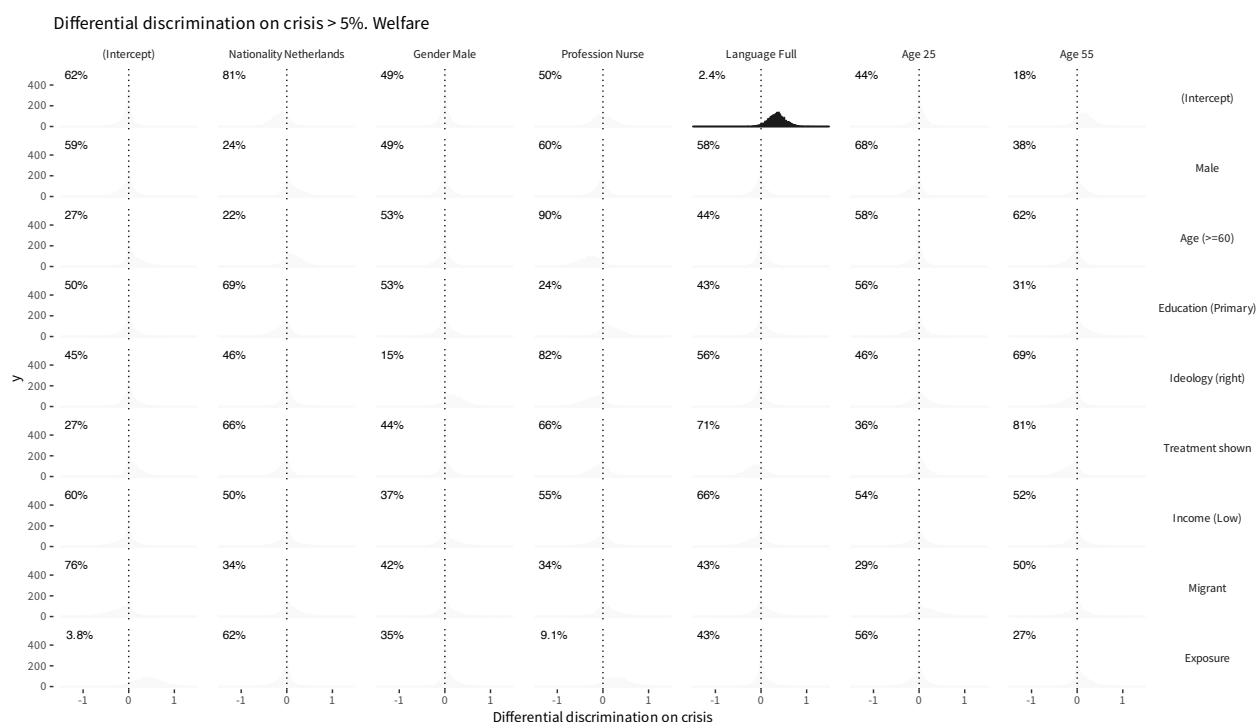


Figure 3.37: Differential discrimination on crisis time over the regular main sample. Only welfare is shown. Values indicate the probability of having found a differential discrimination stronger in crisis.

```
dd.sample %>%
 filter(Outcome = "Rights") %>%
 left_join(fig.labels.Xpercent) %>%
 mutate(Highlight = ifelse(HighlightP = "Highlight", 0.9, 0.1)) %>%
 ggplot(aes(x = `Differential discrimination on crisis`)) +
 geom_histogram(binwidth = 0.01, aes(color = Highlight)) +
 facet_grid(Covariate ~ Feature) +
 geom_text(data = filter(fig.labels, Outcome = "Rights"),
 aes(x = -Inf, y = Inf, label = P),
 size = rel(0.8),
 hjust = -0.5, vjust = +1.5) +
 geom_vline(xintercept = 0, lty = 3) +
 xlim(c(-1.5, 1.5)) +
 ggtitle("Differential discrimination on crisis > 5%. Rights") +
 scale_color_continuous_sequential(palette = "Grays") +
 theme(strip.text.y = element_text(angle = 0)) +
 guides(color = FALSE)
```



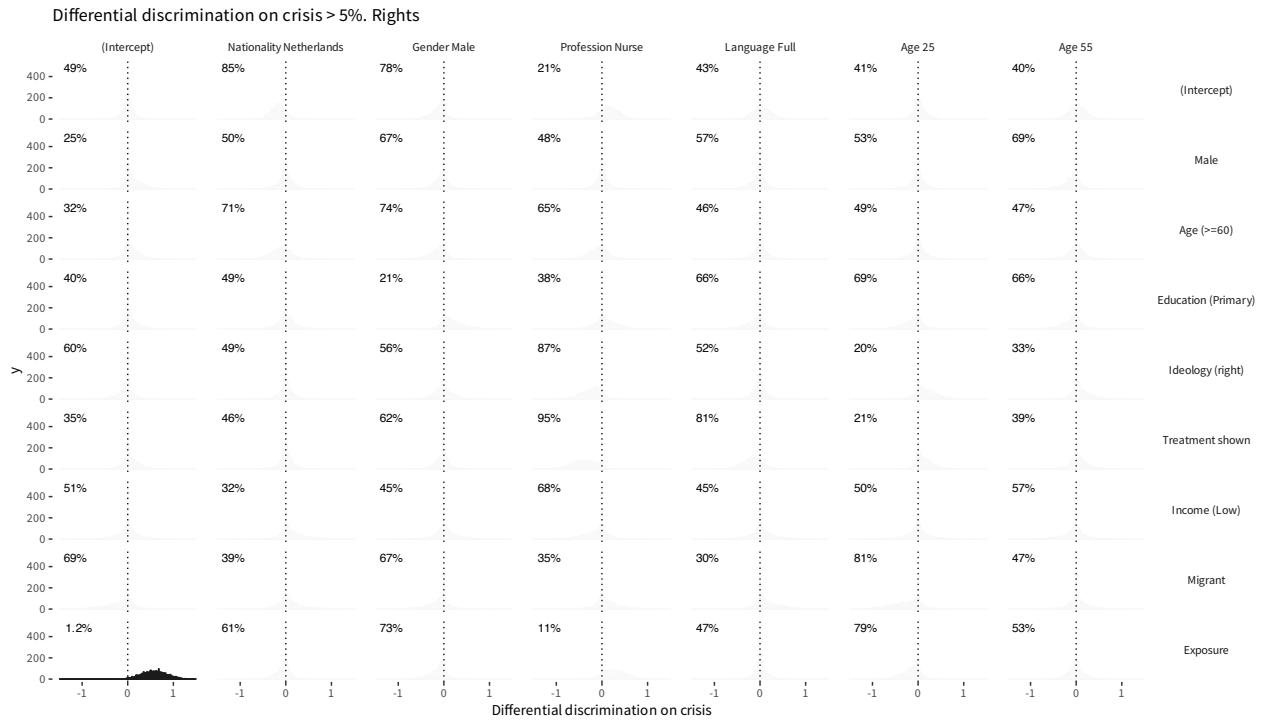


Figure 3.38: Differential discrimination on crisis time over the regular main sample. Only rights is shown. Values indicate the probability of having found a differential discrimination stronger in crisis.

### 3.5 Model fit

```
load(file = paste("samples-p-", M.lab, ".RData", sep = ""))
threshold <- d %>%
 group_by(Outcome, Sample, Treatment) %>%
 summarize(Threshold = length(which(Decision == 1)) / n())

L.p <- plab("p", list(Observation = 1:n0)) %>%
 mutate(Observation = as.integer(as.numeric(as.character(Observation))))

S.full <- ggs(s.p, family = "p\\[", par_labels = L.p, sort = FALSE) %>%
 select(Iteration, Chain, Observation, value) %>%
 left_join(select(d, Observation, Sample, Treatment, Outcome, Decision)) %>%
 left_join(threshold) %>%
 mutate(Correct = if_else((value < Threshold & Decision == 0) |
 (value > Threshold & Decision == 1),
 TRUE, FALSE))

S <- S.full %>%
 group_by(Outcome, Sample, Treatment, Iteration, Chain) %>%
 summarize(PCP = length(which(Correct)) / n())

S.full <- S.full %>%
 select(Observation, Decision, value)

ggplot(S, aes(x = PCP, color = Sample)) +
 geom_density() +
 facet_grid(Treatment ~ Outcome) +
 expand_limits(x = c(0, 1)) +
 geom_vline(xintercept = 0, lty = 3) +
 scale_color_discrete_qualitative(palette = "Dynamic")

t.pcp <- S %>%
 group_by(Sample, Treatment, Outcome) %>%
 summarize(`Average PCP` = paste0(round(mean(PCP) * 100, digits = 1), "%"))

tc <- "Posterior median percent correctly predicted, by outcome, treatment and sample."
tc.oa <- "Model fit using posterior average of percent correctly predicted, by outcome, treatment and sample."
if (knitr::is_latex_output()) {
```

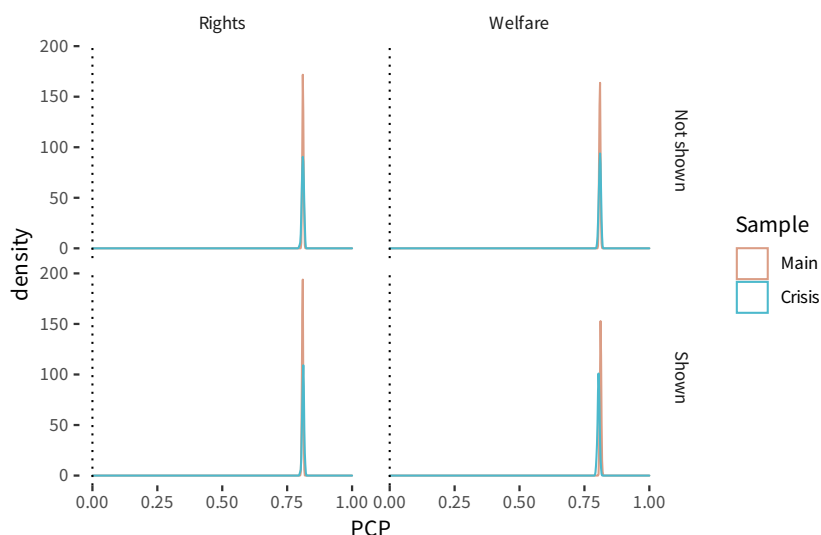


Figure 3.39: Model fit: Percent correctly predicted.

```
kable(t.pcp, format = "latex", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10)
print(xtable(t.pcp, caption = tc.oa, label = "tab:main-pcp"),
 file = "table-main-pcp.tex", include.rownames = FALSE)
} else {
 kable(t.pcp, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10, position = "center", bootstrap_options = "striped", full_width = F)
}
```

### 3.6 Hypothesis 1: Dutch/Full language are treated more favourably in crisis.

These results aggregate individual behaviour.

```
tb <- S.theta %>%
 filter(Feature %in% c("Nationality Netherlands", "Language Full")) %>%
 filter(Covariate == "(Intercept)") %>%
 droplevels() %>%
 select(Iteration, Chain, Outcome, Feature, Sample, value) %>%
 pivot_wider(names_from = Sample, values_from = value) %>%
 group_by(Outcome, Feature) %>%
 summarize(`Prob H1` = paste0(round(length(which(Crisis > Main)) / n() * 100, digits = 1), "%")) %>%
 arrange(desc(`Prob H1`))

tc <- "Evidence for Hypothesis 1."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, longtable = TRUE, booktabs = TRUE) %>%
 kable_styling(font_size = 10)
 print(xtable(tb, caption = tc, label = "tab:main-h1"),
 file = "table-main-h1.tex", include.rownames = FALSE)
} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10, position = "center", bootstrap_options = "striped", full_width = F)
}
```

3.7 *Hypothesis 2 (exposure): respondents will prioritise applicants with Dutch nationality and excellent language skills the more they are/were exposed to the outbreak of COVID-19.*

```
tb <- S.theta %>%
 filter(Feature %in% c("Nationality Netherlands", "Language Full")) %>%
 filter(Covariate == "Exposure") %>%
 droplevels() %>%
 select(Iteration, Chain, Outcome, Feature, Sample, value) %>%
 pivot_wider(names_from = Sample, values_from = value) %>%
 group_by(Outcome, Feature) %>%
 summarize(`Prob H2` = paste0(round(length(which(Crisis > Main)) / n() * 100, digits = 1), "%")) %>%
 arrange(desc(`Prob H2`))

tc <- "Evidence for Hypothesis 2."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, longtable = TRUE, booktabs = TRUE) %>%
 kable_styling(font_size = 10)
 print(xtable(tb, caption = tc, label = "tab:main-h2"),
 file = "table-main-h2.tex", include.rownames = FALSE)
} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10, position = "center", bootstrap_options = "striped", full_width = F)
}
```

3.8 *Hypothesis 3 (vulnerability): Individuals who were most affected by the crisis (or are most likely to feel threatened by COVID-19) – low income, older - will show more discriminatory behaviour.*

```
tb <- S.theta %>%
 filter(Feature %in% c("Nationality Netherlands",
 "Language Full",
 "Gender Male",
 "Profession Nurse",
 "Age 25",
 "Age 55")) %>%
 filter(Covariate %in% c("#Male",
 "#Migrant",
 "Age (≥ 60)",
 "#Education (Primary)",
 "Income (Low)")) %>% #,
 "#Ideology (right)")) %>%

 select(Iteration, Chain, Outcome, Feature, Covariate, Sample, value) %>%
 pivot_wider(names_from = Sample, values_from = value) %>%
 mutate(MoreDiscrimination = ifelse((Main > 0 & Crisis > Main) |
 (Main < 0 & Crisis < Main), TRUE, FALSE)) %>%
 group_by(Outcome, Feature, Covariate) %>%
 summarize(`Prob H3` = paste0(round(length(which(MoreDiscrimination)) / n() * 100, digits = 1), "%")) %>%
 arrange(desc(`Prob H3`))

tb.sub <- tb %>%
 filter(Feature %in% c("Nationality Netherlands", "Language Full"))

tc <- "Evidence for Hypothesis 3."
if (knitr::is_latex_output()) {
 kable(tb, format = "latex", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10)
 print(xtable(tb.sub, caption = tc, longtable = TRUE, label = "tab:main-h3"),
 file = "table-main-h3.tex", include.rownames = FALSE)
} else {
 kable(tb, format = "html", caption = tc, booktabs = TRUE) %>%
 kable_styling(font_size = 10, position = "center", bootstrap_options = "striped", full_width = F)
}
```

}

*Programming environment*

# sessionInfo()

```
R version 4.0.5 (2021-03-31)
Platform: x86_64-pc-linux-gnu (64-bit)
Running under: Gentoo/Linux
##
Matrix products: default
BLAS: /usr/lib64/blas/blis/libblas.so.3
LAPACK: /usr/lib64/libopenblas_haswellp-r0.3.14.so
##
locale:
[1] LC_CTYPE=ca_AD.UTF-8 LC_NUMERIC=C
[3] LC_TIME=ca_AD.UTF-8 LC_COLLATE=ca_AD.UTF-8
[5] LC_MONETARY=ca_AD.UTF-8 LC_MESSAGES=ca_AD.UTF-8
[7] LC_PAPER=ca_AD.UTF-8 LC_NAME=C
[9] LC_ADDRESS=C LC_TELEPHONE=C
[11] LC_MEASUREMENT=ca_AD.UTF-8 LC_IDENTIFICATION=C
##
attached base packages:
[1] parallel grid stats graphics grDevices utils datasets
[8] methods base
##
other attached packages:
[1] readxl_1.3.1 tictoc_1.0.1 xtable_1.8-4
[4] forcats_0.5.1 cowplot_1.1.1 scales_1.1.1
[7] colorspace_2.0-1 stringr_1.4.0 GGally_2.1.1
[10] ggmcmc_1.5.1.1 runjags_2.2.0-2 rjags_4-10
[13] coda_0.19-4 ggthemes_4.2.4 extrafont_0.17
[16] gridExtra_2.3 ggplot2_3.3.4 tidyr_1.1.3
[19] dplyr_1.0.6 kableExtra_1.3.4 tikzDevice_0.12.3.1
[22] rmarkdown_2.9 knitr_1.33 colorout_1.2-2
##
loaded via a namespace (and not attached):
[1] httr_1.4.2 tufte_0.10 viridisLite_0.4.0 splines_4.0.5
[5] assertthat_0.2.1 cellranger_1.1.0 yaml_2.2.1 Rttf2pt1_1.3.8
[9] pillar_1.6.1 lattice_0.20-44 glue_1.4.2 extrafontdb_1.0
[13] digest_0.6.27 RColorBrewer_1.1-2 rvest_1.0.0 Matrix_1.3-4
[17] htmltools_0.5.1.1 plyr_1.8.6 pkgconfig_2.0.3 magick_2.7.2
[21] bookdown_0.22 purrr_0.3.4 webshot_0.5.2 svglite_2.0.0
[25] tibble_3.1.2 mgcv_1.8-36 generics_0.1.0 farver_2.1.0
[29] ellipsis_0.3.2 withr_2.4.2 magrittr_2.0.1 crayon_1.4.1
[33] evaluate_0.14 fansi_0.5.0 nlme_3.1-152 xml2_1.3.2
[37] textshaping_0.3.5 tools_4.0.5 lifecycle_1.0.0 munsell_0.5.0
[41] compiler_4.0.5 systemfonts_1.0.2 rlang_0.4.11 rstudioapi_0.13
[45] filehash_2.4-2 labeling_0.4.2 gtable_0.3.0 DBI_1.1.1
[49] reshape_0.8.8 R6_2.5.0 zoo_1.8-9 utf8_1.2.1
[53] ragg_1.1.3 stringi_1.6.2 Rcpp_1.0.6 vctr_0.3.8
[57] tidyselect_1.1.1 xfun_0.24
```