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Abstract

Previous studies suggested that public trust in government is vital for implementations of social policies that rely on public's behavioural responses. This study examined associations of trust in government regarding COVID-19 control with recommended health behaviours and prosocial behaviours. Data from an international survey with representative samples (N=23,733) of 23 countries were analysed. Specification curve analysis showed that higher trust in government was significantly associated with higher adoption of health and prosocial behaviours in all reasonable specifications of multilevel linear models (median standardised β=0.173 and 0.244, P<0.001). We further used structural equation modelling to explore potential determinants of trust in government regarding pandemic control. Governments perceived as well organised, disseminating clear messages and knowledge on COVID-19, and perceived fairness were positively associated with trust in government (standardised β=0.358, 0.230, 0.055, and 0.250, P<0.01). These results highlighted the importance of trust in government in the control of COVID-19.

Introduction

In order to address the growing public health crisis created by the COVID-19 pandemic, governments across the world need to play an essential role in the prevention and control of the disease while mitigating its economic impact. Numerous countries have introduced responsive measures and regulations to prevent disease transmission (e.g., social distancing, handwashing, self-isolation[1]) and stabilize the economy. However, effective implementation of these measures depends on a high level of compliance and support from the public[2]. Emerging theoretical and empirical evidence suggest that trust in government is crucial to public's compliance with social policies that rely on their behavioural responses[3-5]. As such, understanding the association between trust in government and the adoption of preventive behaviours and exploring various determinants of trust in government during the pandemic are important for the control of COVID-19.

Trust in government represents the confidence and satisfaction of people with government performance[6]. It has been identified as a cornerstone of the political system, particularly in crises such as natural disasters, economic crises, or pandemics. Trust in government produces spontaneous sociability, which in turn leads to cooperative, altruistic, and extraterritorial behaviours in social activities[7-10]. Previous studies demonstrated that the higher level of trust in government was associated with greater willingness to follow a range of government recommendations and prosocial behaviours, such as adopting preventive behaviours to avoid the swine flu[11], abiding mandated social distancing policies during the Ebola outbreak[12], getting vaccinated against seasonal influenza[13], and making economic sacrifice for the environment[14]. More recently, a survey of 2250 residents in the UK during COVID-19 pandemic found that those who trust the government to control the pandemic were slightly more likely to follow the government regulations imposed during lockdown[15].

Compared with the general trust in government which has been shaped over a long time by

various historical, cultural, or political factors, this specific aspect of trust in government regarding the ability and efficacy of COVID-19 control could be more dynamic. Given the importance of maintaining public trust during the pandemic, there is an urgent need to identify the determinants of trust in government regarding COVID-19 control. The Organization for Economic Co-operation and Development (OECD) pointed out that reliability, responsiveness, openness, better regulation, fairness, and inclusive policy making are key areas for governments to gain public trust[5]. In the context of the current pandemic, better regulation and organisation of government in the design and implementation of responsive measures that are well-adapted to local norms could increase public support and trust in government[16]. In addition, the lack of transparency of government has been identified as one of the major elements that have caused the decline of trust in government[17]. Lessons from the SARS pandemic in 2003 also highlighted the importance of transparency and timely and accurate communication[18]. Furthermore, trust in government is influenced by the performance of the national economy and citizens' evaluations of the economy, with negative perceptions of the economy shown to promote greater distrust[19,20]. Finally, perceived fairness which refers to being treated equally as other people in society could also lead to distrust in government, especially during crises[21].

Based on the theoretical background and empirical evidence, we conducted a large-scale international survey focusing on trust in government and behavioural responses from the public during the unprecedented COVID-19 pandemic. The aim of this study was twofold: a) to examine the associations between trust in government on COVID-19 and the adoption of health and prosocial behaviours that are crucial for pandemic control; and b) to explore potential determinants of the COVID-19 related trust in government, including government regulation, clear information or knowledge on COVID-19, economic status, and perceived fairness during the pandemic.

Results

Population characteristics and country-level descriptions

We used data from the PsyCorona project (https://psycorona.org/), a web-based survey that included 23,733 participants from 23 countries who are representative of the population in their country in terms of age and gender. These participants have completed the survey during April 10 to May 11, 2020, of whom 51% are women, 32%, 54%, or 14% are aged between 18-34, 35-64, or over 65 years, and 59%, 29%, or 12% have education level below, equivalent, or above Bachelor's degree.

Data on COVID-19 related trust in government (three items, Cronbach's $\alpha = 0.754$), adoption of personal health behaviours (three items, Cronbach's $\alpha = 0.795$), and adoption of prosocial behaviours (eight items, Cronbach's $\alpha = 0.906$) were analysed (Table 1). Of the three trust-related items, one directly measured trust in country government to take the right response measures, two measured trust of country's ability to fight COVID-19 or its economic consequences. Since the government in all 23 sample countries plays a major role in pandemic control, public's trust in country could reflect their trust in government towards COVID-19.

Two scatter plots were generated with country-level mean values of personal health behaviour items and prosocial behaviour items against mean values of public trust items (Figure 1). A positive correlation was observed between the country-level trust in government and prosocial behaviour ($r = 0.49$, $P = 0.017$), whereas no correlation was observed for the country-level health behaviour ($r = 0.01$, $P > 0.05$).

Specification curve analysis (SCA) for associations of trust in government with health behaviour and prosocial behaviour

Given the fact that there are multiple items on each measure and various analytical options

regarding covariate adjustment, it is difficult to select one optimal model specification without introducing subjective bias. Therefore, we used specification curve analysis[22,23] to examine the individual-level association between trust in government and health behaviour or prosocial behaviour, which considers all reasonable model specifications to avoid subjective analytical decisions. Based on multilevel linear regressions with behaviour measures as dependent variable and country-level intercepts as random effect, multiple analytical options were tested. For each of the three constructs (i.e., trust, health behaviour, prosocial behaviour), relevant items were tested individually and in combination as mean score or through principal component analysis (PCA, Table 1). Results of PCA showed a single principal component with eigenvalue greater than 1 for all three constructs, which represents most variations of corresponding items. In addition, to account for potential confounding bias, three specifications were considered: no covariates, only adjusting for basic demographics (age, gender, and education level), or adjusting for a full set of covariates (see Methods). After combining three model specification factors (dependent variable, independent variable, and covariate adjustment), the total numbers of model specifications are 75 for trust in government and adoption of health behaviour (5 for trust × 5 for health behaviour × 3 for covariates), and 210 for trust in government and prosocial behaviour (5 for trust × 14 for prosocial behaviour × 3 for covariates).

All 75 model specifications for multilevel linear regression of COVID-19 related health behaviour on trust in government revealed significant positive association (maximum P for single test = 6×10^{-5}). The standardised β coefficients and standard errors (SE) obtained for this association from all specifications are plotted in Figure 2, with a median standardised β of 0.173 (median SE = 0.007). Similarly, the median standardised β of 15 specifications with the single-item direct measure of trust in government as independent variable was 0.123 (median SE = 0.007). To test the overall hypothesis that stronger trust in government

regarding pandemic control was associated with higher compliance with recommended health behaviours, we used bootstrapping technique to perform joint significance tests. After creating a pseudo dataset where the null hypothesis is true (i.e., true $\beta = 0$; see Methods), the SCA was repeated on 1000 re-sampled datasets which resulted in the distributions of estimated median β value and number of significant tests under the null hypothesis. Results of bootstrapped tests showed that the probability of having a median $\beta > 0.173$ or < -0.173 (i.e., stronger than in original SCA), or getting 75 significant tests by chance was below 0.001 when the null hypothesis is true.

Furthermore, the SCA visualised the influences of different analytical options on the effect estimates (Figure 2). The health behaviour of self-quarantine had a slightly weaker association with trust (median $\beta = 0.156$, median SE = 0.007) than washing hands more frequently or avoiding crowded space (median $\beta = 0.180$ or 0.176, median SE = 0.007). Not adjusting for covariates or only adjusting for basic demographics yielded similar effect estimates (median $\beta = 0.208$ or 0.201, median SE = 0.007 or 0.006), whereas adjusting for a full set of covariates showed a weaker independent effect of trust in government on adoption of health behaviour (median $\beta = 0.115$, median SE = 0.007).

As for the association between trust in government and COVID-19 related prosocial behaviour, all 210 model specifications of multilevel linear regression revealed significant positive association (maximum P for single test = 2×10^{-16}). The median standardised β coefficient obtained from all specifications was 0.244 (median SE = 0.006; Figure 3). Bootstrapped tests with 1000 re-sampled datasets showed that, when the null hypothesis is true, the possibility of having a median $\beta > 0.244$ or < -0.244 (i.e., stronger than in original SCA), or getting 210 significant tests by chance was below 0.001. Therefore, the null hypothesis was rejected and the existence of the association between trust in government regarding pandemic control and willingness to adopt prosocial behaviour was confirmed.

As shown in Figure 3, trust of country's ability to fight the economic consequences had a stronger association with adoption of prosocial behaviour (median β = 0.265, median SE = 0.006) than trust of country's ability to fight the coronavirus or trust in government to take right response measures (median β = 0.225 or 0.177, median SE = 0.006). Similar to the situation in SCA for health behaviour, controlling for a full set of covariates resulted in a weaker independent effect of trust in government on prosocial behaviour (median β = 0.197, median SE = 0.007).

Structural equation model (SEM) for potential determinants of COVID-19 related trust in government and behaviour

After establishing the associations between trust in government and health and prosocial behaviours, we further built an integrated model with multilevel SEM to explore potential determinants of trust in government in the context of COVID-19 control. In this generalised SEM, associations of hypothesised determinants with trust in government, and their direct associations (not through trust in government) with health and prosocial behaviours were estimated based on multilevel linear regressions, with country-level intercepts as random effects. Three latent variables were created: overall trust in government regarding pandemic control which determined the three measured items, willingness to adopt recommended health behaviour which determined the three health behaviour items, and willingness to adopt prosocial behaviour which determined the eight prosocial behaviour items (Figure 4).

After controlling for potential confounding variables (age, gender, education level, religion, citizenship, and close relationship with infected patients), the overall trust in government regarding pandemic control was positively associated with willingness to adopt recommended health and prosocial behaviours (standardised β = 0.206 and 0.378, SE = 0.030 and 0.039; $P < 0.001$), which further supported the findings from the SCA models (Figure 4). As for the hypothesised determinants, governments being well-organised in response to the

pandemic, more fairness, more clear messages received on coping with COVID-19, and more knowledge on COVID-19 were associated with higher level of overall trust in government (standardised β = 0.358, 0.250, 0.230, and 0.055, SE = 0.019, 0.027, 0.026, and 0.019; P < 0.01). In contrast, employment status and personal financial strain were not significantly associated with overall trust in government regarding pandemic control (standardised β = -0.012 and -0.007, SE = 0.009 and 0.013; P > 0.05). The fitting indices demonstrated an acceptable fit between this SEM and the data (root mean square error of approximation = 0.038, standardised root mean square residual = 0.026, comparative fit index = 0.846). The sensitivity analyses without adjusting for potential confounding variables or using the single-item direct measure of trust in government yielded similar results.

Furthermore, perceived knowledge and message clarity on COVID-19, fairness, and personal financial strain also had direct associations with willingness to adopt recommended health behaviour (standardised β = 0.206, 0.153, -0.120, and 0.047, SE = 0.018, 0.014, 0.014, and 0.012; P < 0.001). Governments being well-organised had direct association with prosocial behaviour (standardised β = 0.069, SE = 0.026; P < 0.01) but not health behaviour (P > 0.05). Besides, perceived knowledge and message clarity on COVID-19, fairness, and unemployment were directly associated with prosocial behaviour (standardised β = 0.068, 0.052, -0.045, and -0.046, SE = 0.020, 0.021, 0.015, and 0.010; P < 0.05).

Discussion

In this large-scale cross-country study focusing on COVID-19 related trust in government, we found a robust relationship between trust and personal preventive behaviour. A higher level of trust in government regarding COVID-19 control was significantly associated with higher compliance with measures of frequent handwashing, avoiding crowded spaces, and social isolation/quarantine. This result is consistent with previous findings that public trust was associated with adherence to public health interventions[21,24-27]. Two representative surveys in Liberia and Congo during the Ebola outbreaks also indicated that trust in government was positively related to compliance with disease control measures[12] or adoption of personal preventive behaviours (e.g., keeping social distance and accepting Ebola vaccines)[28]. Conversely, it has been argued that the limited trust in government could make the control of COVID-19 more difficult, especially in low and middle income countries[29]. The reduced acceptance of official information caused by distrust in government fosters the spread of fake news and misinformation[4], which could substantially affect the formation of people's health behaviours.

In addition, our results showed a significant positive association between trust in government and willingness to engage in prosocial behaviours that aid the control of COVID-19 pandemic. This is in line with a number of previous studies where higher levels of trust in government are related to more support for public welfare policies and willingness to sacrifice personal material interests[30-32]. As hypothesised, in a low-trust environment, citizens will prioritize immediate and partial benefits[33], whereas high levels of trust towards the long-term benefits of public policies could produce spontaneous sociability that motivates the self-sacrifice of some immediate benefits[7,34]. Our study further affirmed this statement in the context of the current public health crisis. Moreover, we found that the trust of fighting the economic consequences had a stronger association with prosocial behaviour compared with

trust on disease control, which is plausible because the reduction in people's financial concern may increase their altruistic behaviours such as donation.

In the context of this worldwide pandemic, the international cooperation between governments and people all over the world is the key to stop the spreading of the coronavirus. Both personal preventive health behaviour and the prosocial behaviour that offers support for others are essential for fighting the COVID-19. In this regard, building public trust in government regarding disease control could serve as an effective strategy to achieve a better cooperation and compliance of COVID-19 related policies and interventions, and ultimately improve the prevention and control of this disease.

Given the importance of trust in government on COVID-19, we further explored its determinants which are modifiable for a better translation into public policies. Results showed that government that was perceived as well organised in response to COVID-19, clear messages and perceived knowledge on COVID-19, and perceived fairness were positively associated with trust in government. This implies that clear information such as the number of infected cases, the capacity of the healthcare system, and unambiguous health instructions that represent government transparency and effective communication are important in terms of maintaining public trust[35,36]. In fact, a recent survey in the UK revealed a significant increase in the percentage of people who were concerned about false or misleading information about coronavirus from the government from April to May, 2020[37]. Our result on perceived fairness is in line with previous studies that linked feelings of social inequality with less trust in government or public health institutes[21,38]. Therefore, the fairness in the pandemic control should be treated with caution.

The strength of this study lies in its large and representative samples from diverse geographic regions worldwide, which is especially important in the investigation of trust in government.

Moreover, we collected information on potential confounding variables, as well as potential determinants of trust in government to shed light on practical implications. From a methodological perspective, this study expanded the application of SCA in a dataset with hierarchical structure by employing multilevel linear regressions with random intercept in all model specifications. In consideration that this is a cross-country survey, such methodological development is useful to avoid intra-group correlations while increasing statistical power for individual-level variables[39] in SCA models.

Nevertheless, this study has several limitations. Due to the cross-sectional design of this study, causal inferences for the hypothesised determinants of trust in government and its behavioural impact on pandemic control need to be confirmed by future longitudinal studies with follow-up data. Furthermore, a more detailed investigation on different aspects or dimensions of COVID-19 related trust in government or health institutes, such as the trust of detection capacity, clinical pathways, or vaccination, is needed for a comprehensive understanding of this topic.

In conclusion, this study demonstrates that stronger trust in government on COVID-19 control is associated with higher willingness to adopt recommended health and prosocial behaviours. In addition, governments being better organised in response to the pandemic, more unambiguous messages received and perceived knowledge on COVID-19, and higher perceived fairness are associated with higher level of trust in government. Relevant public policies targeting to improve public trust in fighting the coronavirus and dealing with secondary consequences could hugely facilitate the control of the pandemic.

Methods

Data source. This study was based on cross-sectional data from the PsyCorona Survey on COVID-19 (Project website: https://psycorona.org). This 20-minute web-based survey, translated into 30 languages, aimed to investigate the psychological impact of the coronavirus spread. During April 10 to May 11, 2020, the PsyCorona Survey actively recruited representative samples from 23 countries. Participants were sampled online through Qualtrics' panel management service, so that they are representative of the country's general population in terms of gender and age. About 1000 participants were selected for each of the 23 countries (Argentina, Australia, Brazil, Canada, France, Germany, Greece, Indonesia, Italy, Japan, Netherlands, Philippines, Romania, Russia, Saudi Arabia, Serbia, South Africa, South Korea, Spain, Turkey, the United Kingdom, Ukraine, and the United States of America).

Ethical review. PsyCorona Survey was approved by the Ethical Committee of the University of Groningen and New York University Abu Dhabi: ecp@rug.nl (study code: PSY-1920-S-0390); irbnyuad@nyu.edu (study code: HRPP-2020-42). All participants gave informed consent before taking the survey.

Measures. This study focused on the measures of trust in government regarding COVID-19 control, adoption of recommended health behaviours, and willingness to engage in COVID-19 related prosocial behaviours (Table 1). Of the three items on trust in government, one was rated in 5-point scale from 1 (not at all) to 5 (a great deal) and two were in 7-point scale from -3 (strongly disagree) to 3 (strongly agree). All three items on health behaviour and eight items on prosocial behaviour were in 7-point scale from -3 (strongly disagree) to 3 (strongly agree).

In addition, information on a set of covariates were collected in the survey, including age group, gender, education level, citizenship, religion, close relationship with infected patients,

employment status, personal financial strain, perceived fairness, knowledge on COVID-19, clear messages received on COVID-19, and government being well-organised in response to the pandemic. Details of relevant items are displayed in Supplementary Table 1.

Eligible participants. A total of 24,261 participants selected from 23 countries completed the survey. We excluded participants with any missing values in items on trust in government, health and prosocial behaviours, age group, and gender, which resulted in a sample of 23,733 participants for this study (sample size of each country varies from 738 to 1159). Complete case analysis was used to deal with missing values on covariates in relevant analyses (each covariate had 0 to <1% missing values).

Specification curve analysis (SCA). Associations of trust in government with health and prosocial behaviours were examined. Since there are multiple items for each construct and various analytical options for testing the association, SCA was adopted which covers all reasonable model specifications[22,23]. Three model specification factors were considered: 1) Dependent variable (health behaviour and prosocial behaviour were analysed separately; items on each construct were tested individually, or in combination as mean score or principal component score based on PCA); 2) Independent variable (items on trust in government were used individually, or in combination as mean score or principal component score); 3) Covariate adjustment (no covariates; only adjusting for age, gender, education level; or adjusting for a full set of covariates as mentioned above).

SCA was implemented based on multilevel linear regression, with country-level intercept as random effect. All variables in the regression models were standardised before implementation. After testing all model specifications, the median standardised β and median SE were used as summary statistics. Due to missing values in covariates, the sample sizes were 23,733, 23,693, and 23,406 for models with no covariates, with adjustment for age,

gender, education level, and fully adjusted models, in SCAs for health behaviour as well as for prosocial behaviour.

For the overall statistical inferences of SCA, a bootstrapping technique was used. A pseudo-dataset was created by replacing the original dependent variable with the residuals in each model specification, where the null hypothesis holds. Using random sampling with replacement, 1000 bootstrapped datasets of equal size as the pseudo-dataset were generated, on which 1000 repeated SCAs were conducted. The null hypothesis (i.e., no association between trust in government and behaviour) was rejected if the possibility of re-sampled median standardised β being larger in magnitude than observed value in original SCA was below 0.05, or the possibility of getting an equal or larger number of significant tests as in original SCA by chance was below 0.05.

Structural equation model (SEM) analysis. Associations between potential determinants of trust in government, latent variable of trust in government, and latent variables of health and prosocial behaviours were tested in generalised SEM analysis. Hypothesised determinants of trust in government regarding pandemic control include employment status (employed, not employed, or other), personal financial strain (in 5-point scale from -2 [strongly disagree] to 2 [strongly agree]), perceived fairness (in 5-point scale from -2 [strongly disagree] to 2 [strongly agree]), knowledge on COVID-19 (in 5-point scale from 1 [not at all knowledgeable] to 5 [extremely knowledgeable]), receiving clear messages on coping with COVID-19 (in 6-point scale from 1 [messages are completely unclear/ambiguous] to 6 [messages are very clear/unambiguous]), and government being well-organised in response to pandemic (in 6-point scale from 1 [not at all] to 6 [very much]; Supplementary Table 1). In addition, the SEM also serves as a complementary analysis to SCA by estimating the associations between latent variables of overall trust in government and willingness to adopt health and prosocial behaviours.

In the SEM analysis, country was controlled as random-intercept effects and other covariates were modelled as fixed effects. Standardised regression coefficients were estimated and tested in all linear regression models. Multiple fitting indices were calculated to evaluate the overall model fit.

All statistical analyses were conducted using R software (version 4.0.0). Codes for SCA were adapted from functions developed by Orben and Przybylski[23]. The sem function of lavaan package was used for the SEM analysis. Where applicable, $P < 0.05$ indicates statistical significance.

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Competing Interests

The authors declare no competing interests.

Tables and figures

Table 1. Items on trust in government, health behaviour, and prosocial behaviour with possible model specifications (analytical options)

Constructs	Items	Analytical decisions
Trust in government	In general, how much do you trust the government of your country to take the right measures to deal with the coronavirus pandemic? I think that this country is able to fight the coronavirus. I think that this country is able to fight the economic and financial consequences of coronavirus.	Each item individually; mean of the three items; the first principal component of three items (which represents 68% of total variability).
Personal health behaviour	To minimize my chances of getting coronavirus, I wash my hands more often. To minimize my chances of getting coronavirus, I avoid crowded spaces. To minimize my chances of getting coronavirus, I put myself in quarantine.	Each item individually; mean of the three items; the first principal component of three items (which represents 69% of total variability).
Prosocial behaviour	I am willing to help others who suffer from coronavirus. I am willing to make donations to help others that suffer from coronavirus. I am willing to protect vulnerable groups from coronavirus even at my own expense. I am willing to make personal sacrifices to prevent the spread of coronavirus. To help with the economic and financial consequences of coronavirus, I am willing to help others who suffer from such consequences. To help with the economic and financial consequences of coronavirus, I am willing to make donations to help others that suffer from such consequences. To help with the economic and financial consequences of coronavirus, I am willing to protect vulnerable groups from such consequences, even at my own expense. To help with the economic and financial consequences of coronavirus, I am willing to make personal sacrifices.	Each item individually; mean of the first four items (prosocial behaviour on disease control), the last four items (prosocial behaviour on economic consequence), or all eight items; the first principal component of the first four items, the last four items, or all eight items (which represents 60%, 72%, or 58% of total variability, respectively).

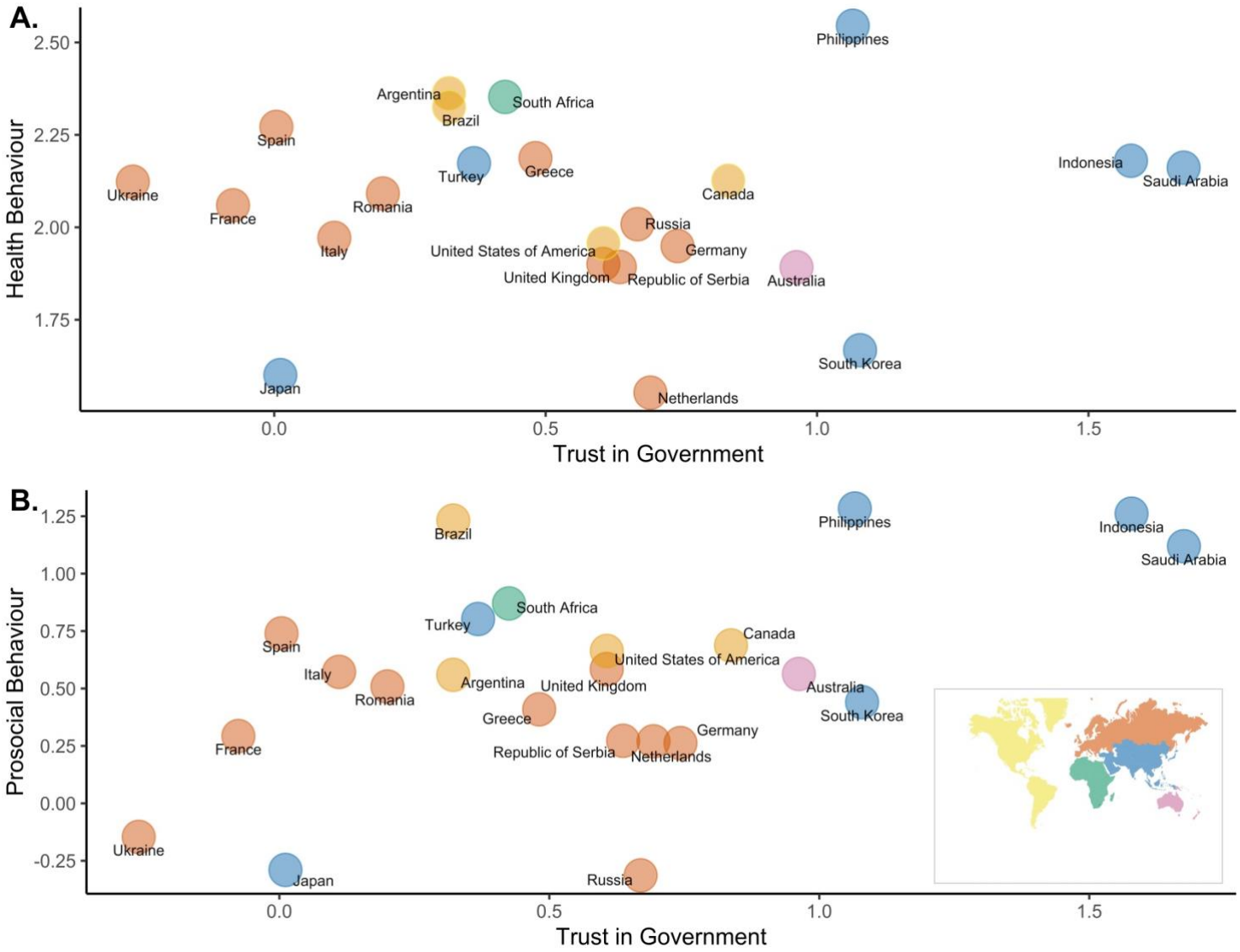

Figure 1. Scatter plots of country-level mean values of personal health behaviour items (A) and prosocial behaviour items (B) against mean values of trust in government items.

23 countries from the five continents are displayed as circles in each plot. Each colour corresponds to a particular continent. Three items on trust in government were harmonised into 7-point scale from -3 (strongly disagree) to 3 (strongly agree); three items on health behaviour and eight items on prosocial behaviour were in similar scale from -3 to 3.

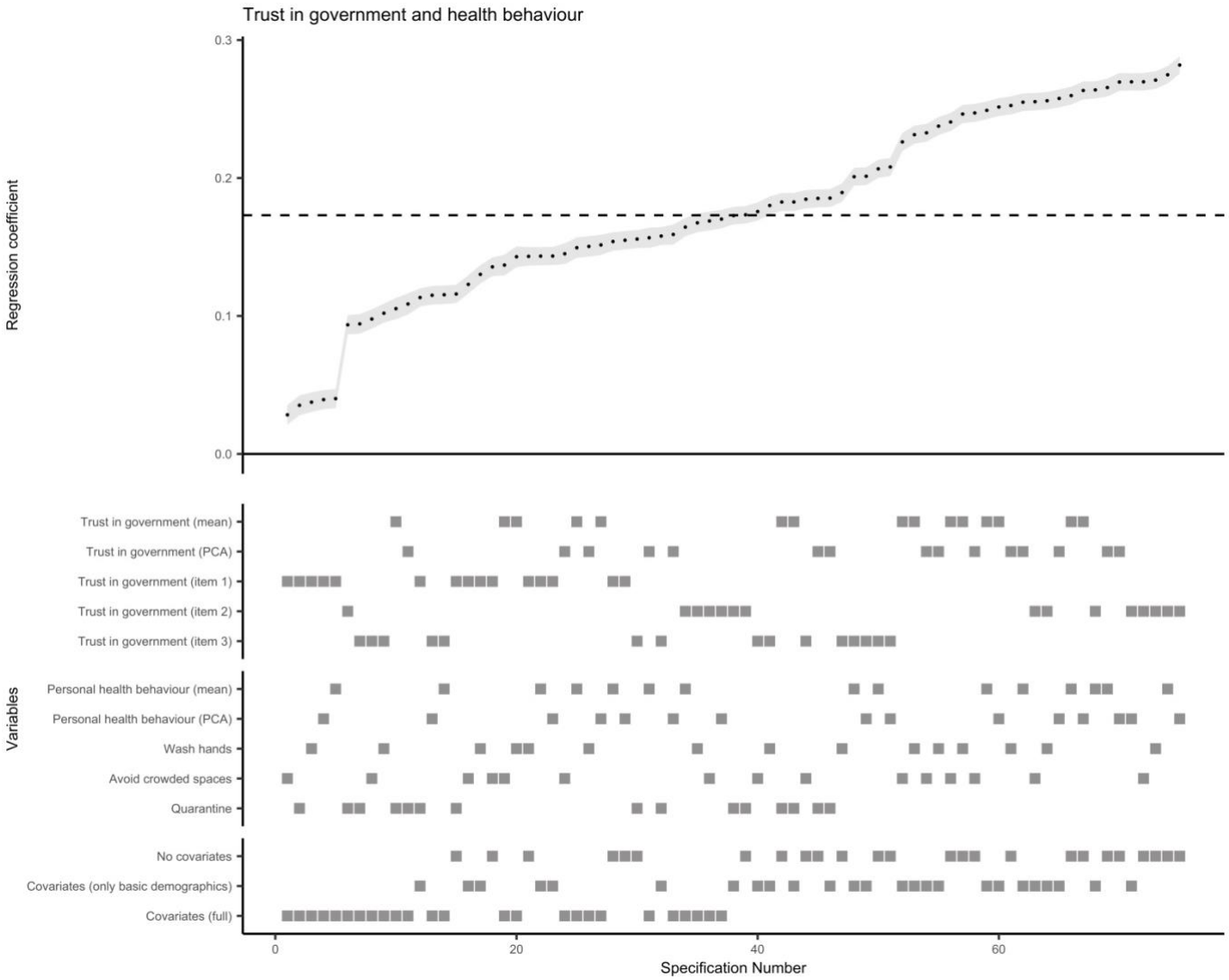

Figure 2. Results of specification curve analysis for trust in government and adoption of personal health behaviour.

The standardised β coefficients for the association of trust in government with health behaviour obtained from all 75 specifications (listed on x axis) are plotted at the upper half of the graph. Each point represents the β coefficient of one specification, and the error bar (in grey) represents the corresponding standard error. The dotted line indicates the median standardised β coefficient (median β = 0.173, median standard error = 0.007, median sample size = 23,693). At the lower half of the graph, the corresponding specifications for each level of the three model specification factors are displayed as squares.

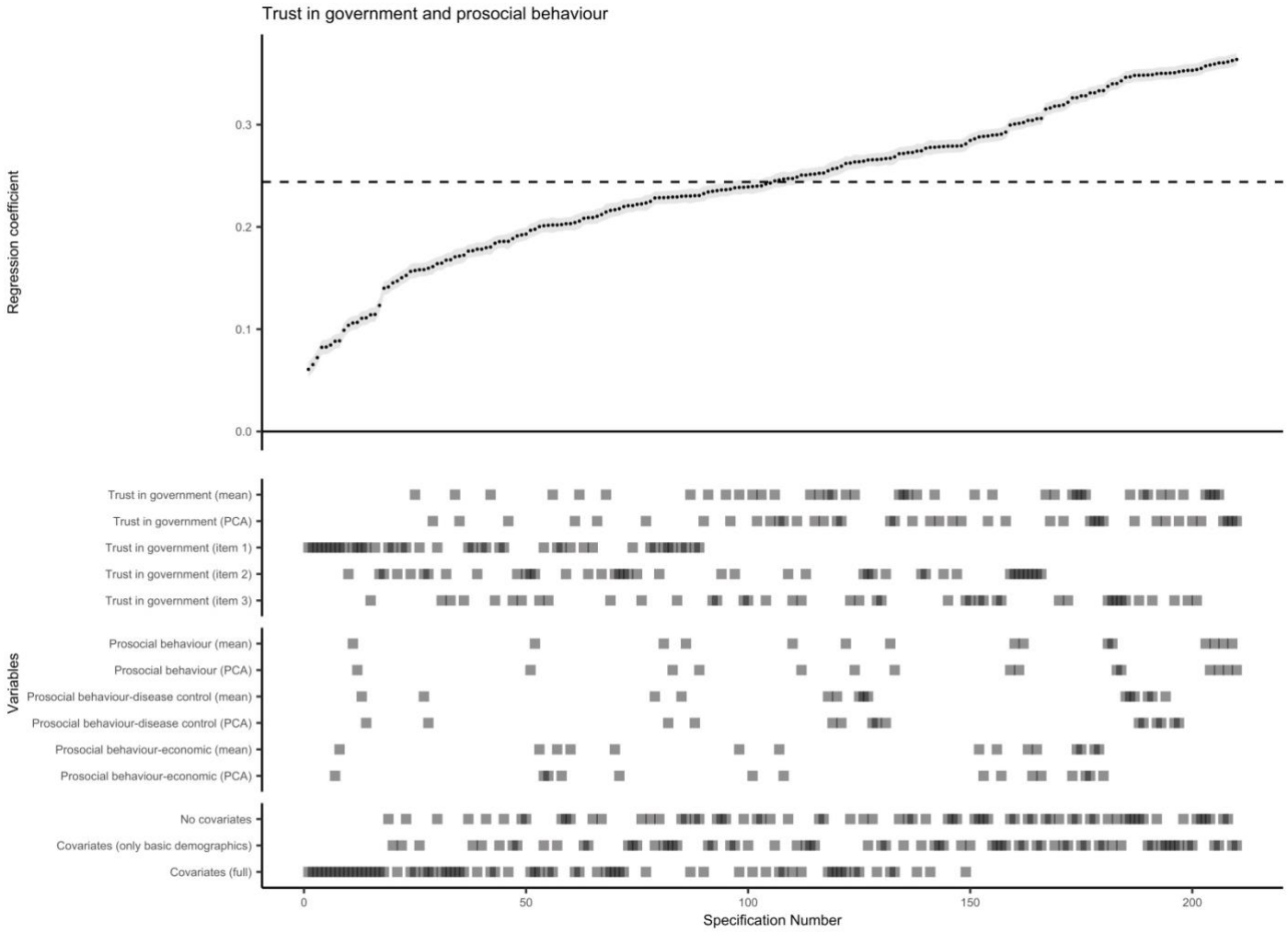

Figure 3. Results of specification curve analysis for trust in government and adoption of prosocial behaviour.

The standardised β coefficients for the association of trust in government with prosocial behaviour obtained from all 210 specifications (listed on x axis) are plotted at the upper half of the graph. Each point represents the β coefficient of one specification, and the error bar (in grey) represents the corresponding standard error. The dotted line indicates the median standardised β coefficient (median β = 0.244, median standard error = 0.006, median sample size = 23,693). At the lower half of the graph, the corresponding specifications for each level of the three model specification factors are displayed as squares.

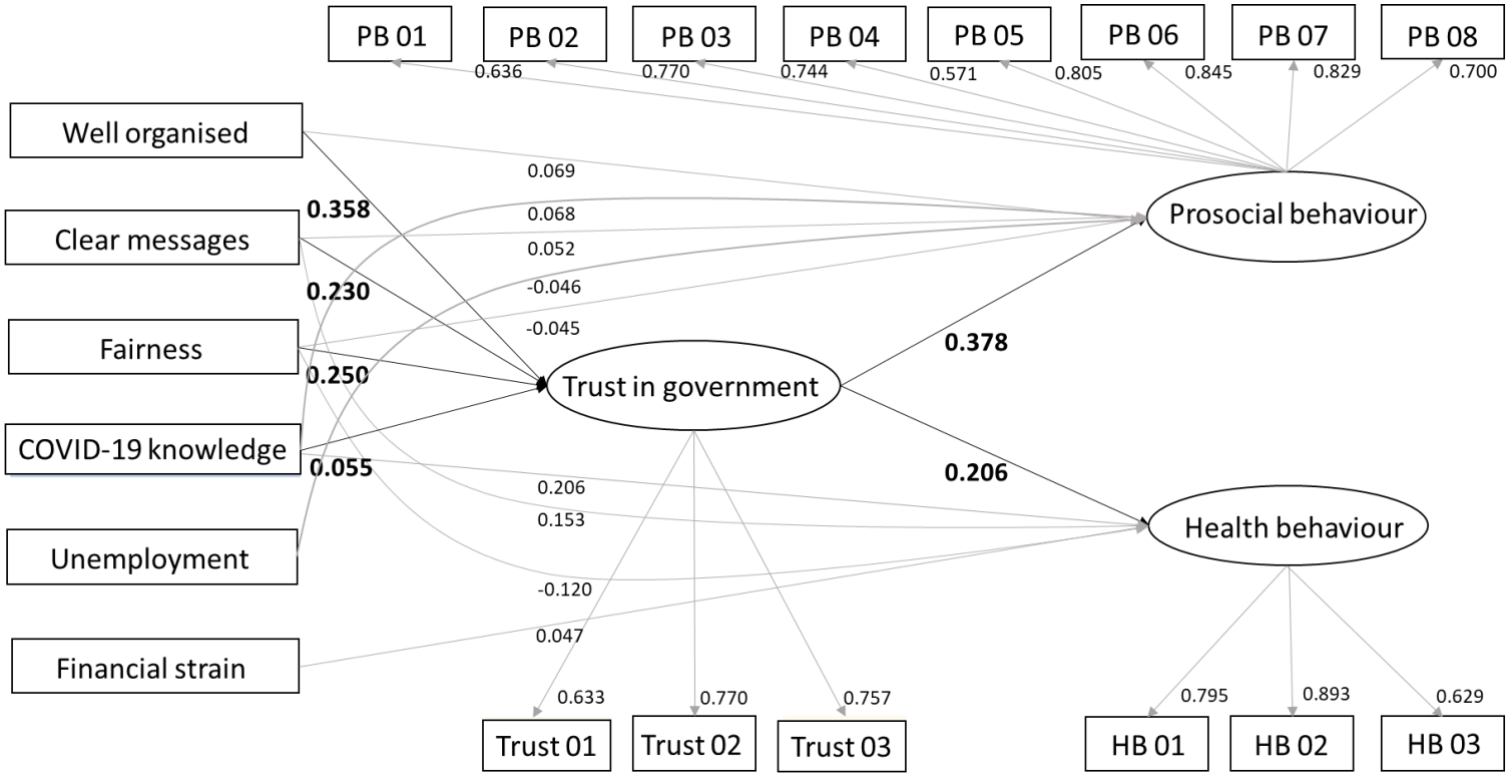

Figure 4. Results of structural equation model analysis.

Only paths with significant regression coefficients ($P < 0.05$) are plotted. Standardised β coefficients are displayed on the lower-right side of the corresponding paths. Trust 01-03 refer to the three items of trust in government; HB 01-03 refer to the three items of health behaviour; PB 01-08 refer to the eight items of prosocial behaviour.

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