International Journal of Environment and Climate Change

Volume 13, Issue 6, Page 23-47, 2023; Article no.IJECC.98119
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Climate Change Data: Use of an Autoregressive (AR) Model in Presence of Change Points under a Bayesian Approach

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Authors' contributions

This work was carried out in collaboration between both the authors. Both authors have read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i61795

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here:
https://www.sdiarticle5.com/review-history/98119

Received: 22/01/2023
Accepted: 28/03/2023
Published: 08/04/2023

Original Research Article

ABSTRACT

In this study, we introduce a statistical model applied to climate change data consisting of an autoregressive times series (AR) model which represents a type of random process. A Bayesian approach using MCMC (Markov Chain Monte Carlo) methods is considered to get the inferences of interest. The main goal of the study is to have a model to get good predictions for mean temperature and also good to identify the time of possible change-points that might be present in the time series which could indicate the possible beginning of a change in climate. Applications of the proposed model are considered using annual average temperatures in some locations obtained over a period of time ranging from the end of 1800's to a popular Bayesian discrimination criterion using MCMC methods.In addition to a good fit of the proposed model for the data, the model also was used to detect the times of climate changes in the different climate stations using CUSUM methodology.

Keywords: Climate data; AR models; change-points; annual mean temperature; Bayesian approach; MCMC methods.

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1 INTRODUCTION

Climate change is of great concern since great changes in temperature and precipitation has been observed worldwide in the last years (see, for instance, [1, 2]. See also https://www.un.org /en/sections/issues-depth/climate-change/ - accessed on 01 July 2021). In the last decades we have seen glaciers shrinkage, earlier melting of the ice in rivers and lakes, changes in plant and animal areas, and earlier owering of trees in different parts of the world ([3], [4]). As a special case, precipitation during winter and spring is projected to be higher for the northern part of the USA, and lower for the southwest. Additionally, for many regions of the planet there are predictions that heat waves will become more intense and cold waves will be less intense everywhere (see, for instance, https://www.ncdc.noaa.gov/monitoring-references/faq/indicators.php). In the last decades, the global average temperature increased approximately $0.1 - C(0.18 - F)$ per decade in the years from 1920 to 1940 (http://www.currentresults.com/Environment-Facts/changes-in-earth-temperature.php - accessed on 01 July 2021). From 2000 to 2009 the annual average global temperature has been $0.61 - C(1.1 - F)$ higher than the period ranging from 1950 to 1980. The use of different statistical models has been considered in the literature as indispensable tools in the analysis of climate data. Therefore, it is very important to introduce new statistical models to be used in the forecast of temperature (or precipitation) and also to detect years of climate change-points.

The literature introduces many studies in climate change, a subject of general interest. [5] study the impact of climate change on water resources and flooding; [6] deal with the relation between climate change and health effects; [7] perform an analysis of the changes in global temperature taking into account the time period since the pre-industrial era; [8] study the relation between global warming and climate change; [9] analyse the impact of climate change on the costal areas of Bangladesh; [10] deal with sea level changes in connection to global warming; [11] study the impact of climate change on migration; [12] describes the developments in the understanding of how temperature and humidity have changed; [13] study the impact of climate change on the marine life; [14] analyse the impact of climate change on the sub-Saharan Africa; [15] study the health effects of future food production under climate change; [16] analyse the threat posed on ecosystems by climate change; [17] present an analysis of the relation between temperature increase and crop production; [18] gives a statistical analysis of change in the global temperature; [19] study the changes in extreme temperature; [20] study the joint change in temperature and precipitation from multiple climate models under a Baysian approach. See also, [21]; [22]; [23] and [24].

The presence of specific change-points in climate time series also were studied by many authors; [25] and [26], considered Bayesian approaches to study change-point problems for climate data; [27], assumed autoregressive series in the detection of climate change-points; [28] studied change-points detection applied to temperature and precipitation data; and [29] used a genetic algorithm to detect change-points in climate data.

Given the complexity of the likelihood function considering the presence of change-points, many authors assume a Bayesian approach using Markov Chain Monte Carlo (MCMC) methods to get inferences for the parameters of the proposed models (see, for example, [30]; [31]; [25]; [26]; [32]; [33]; [34]).

In the present work, the estimation of the location of the possible change-points are obtained assuming an autoregressive model (AR) for annual mean temperatures under a Bayesian approach using MCMC methods. From the obtained Monte Carlo we obtain contrasts (diferences of the estimated means for consecutive years) and CUSUM (cumulative sum control) chats to detect possible years of climate change.

The paper is organized as follows: section 2 presents the methodology used in the data analysis. Section 3 introduces some applications with temperature data from four climate stations followed by long periods of time. Finally, Section 4 presents some concluding remarks.

2 METHODOLOGY

Different existing times series models could be fitted for the annual mean climate variables as MA (moving average) models or ARIMA (Autoregressive Integrated Moving Average) models (see for example, [35]; [36]; [37]). In this work, we consider the use of a simple AR (autoregressive) model in the analysis of climate (temperature) variables which gives a good fit for the data and from the fitted model we explore the behavior of the climate times series for possible change-points. Assuming temporal climate data, as for example, monthly or annual averages of temperature denoted by a random variable Y which could be transformed (e.g., logarithm transformation), we consider a autoregressive model AR(J) of order J, given by,

$$
\begin{aligned}
&\text{Model AR(1)}: \; y_1 = \alpha_0 + \epsilon_1, \quad y_2 = \alpha_1 y_1 + \epsilon_2, \quad y_i = \alpha_1 y_{i-1} + \epsilon_i, \quad \text{for} \quad i = 3,4,5,\cdots,n \\
&\text{Model AR(2)}: \; y_1 = \alpha_0 + \epsilon_1, \quad y_2 = \alpha_1 y_1 + \epsilon_2, \quad y_3 = \alpha_1 y_2 + \alpha_2 y_1 + \epsilon_3, \\
&\qquad y_i = \alpha_1 + y_{i-1} + \alpha_2 y_{i-2} + \epsilon_i, \qquad \text{for} \quad i = 4,5,\cdots,n. \\
&\text{Model AR(3)}: \; y_1 = \alpha_0 + \epsilon_1, \quad y_2 = \alpha_1 y_1 + \epsilon_2, \quad y_3 = \alpha_1 y_2 + \alpha_2 y_1 + \epsilon_3, \\
&\qquad y_4 = \alpha_1 y_3 + \alpha_2 y_2 + \alpha_3 y_1 + \epsilon_4, \qquad y_i = \alpha_1 y_{i-1} + \alpha_2 y_{i-2} + \alpha_3 y_{i-3}, \\
&\qquad \text{for} \quad i = 5,6,\cdots,n. \\
&\text{Model AR(4)}: \; y_1 = \alpha_0 + \epsilon_1, \quad y_2 = \alpha_1 y_1 + \epsilon_2, \quad y_3 = \alpha_1 y_2 + \alpha_2 y_1 + \epsilon_3, \\
&\qquad y_4 = \alpha_1 y_3 + \alpha_2 y_2 + \alpha_3 y_1 + \epsilon_4 \qquad y_5 = \alpha_1 y_4 + \alpha_2 y_3 + \alpha_3 y_2 + \alpha_4 y_1 + \epsilon_5, \\
&\qquad y_i = \alpha_1 y_{i-1} + \alpha_2 y_{i-2} + \alpha_3 y_{i-3} + \alpha_4 y_{i-4} + \epsilon_i, \\
&\qquad \text{for} \quad i = 6,7,\cdots,n.
\end{aligned}
\tag{2.1}
$$

where ϵ_i is an error term (a not observed random variable) assumed to be independent, identically distributed with a normal distribution $N(0, \sigma^2)$. Similarly for other AR(J) models where $J > 4$.

We assume a Bayesian analysis for the data assuming the model defined in (2.1). Combining the joint prior distribution for the parameters of the assumed model with the likelihood function given by,

$$L(\alpha_0, \alpha_1, \cdots, \alpha_{j-1}, \sigma^2) = \prod_{i=1}^{n} \frac{1}{\sqrt{2\sigma^2}} \exp\left\{-\frac{\epsilon_i^2}{2\sigma^2}\right\} \tag{2.2}$$

where ϵ_i is obtained from (2.1) for $i = 1,2,3,\cdots,n$, the joint posterior distribution for the parameters of the model is obtained using the Bayes formula [38]. The posterior summaries of interest are obtained using Markov Chain Monte Carlo (MCMC) simulation methods as the popular Gibbs sampling algorithm or the Metropolis-Hastings algorithm ([33]; [39]) using the free existing OpenBUGS software [40]. Since the OpenBugs software only requires the likelihood function and the prior distributions for each parameter of the model, we do not present here all conditional posterior distributions $p(\theta_j/\boldsymbol{\theta}_j$, data), where $\boldsymbol{\theta}_j$ denotes the vector of all p parameters of the model except $\theta_j, j = 1,2,\cdots,p$ needed for the Gibbs sampling or Metropolis-Hastings algorithms (see for example,[41]).

For a Bayesian analysis, we assume independent prior distributions given by, normal distributions $N(0, a^2)$ for the parameters $\alpha_0, \alpha_1, \cdots, \alpha_{J-1}$ and a uniform prior $U(0, b)$ for the parameter $\varphi = 1/\sigma^2$. The hyperparameters a and b, are assumed known.

2.1 Model Discrimination Criterion - Deviance Information Criterion (DIC)

In the discrimination of better model, we use the DIC criterion thais is very popular to discriminate Bayesian models using MCMC methods. In our case we discriminate the proposed model (2.1) considering different choices of AR(J) structures.

The DIC criterion [42] is based on the posterior mean of deviance. The deviance is defined by

$$D(\boldsymbol{\theta}) = -2\ln(L(\boldsymbol{\theta})) + C \qquad (2.3)$$

where $\boldsymbol{\theta}$ is a vector of unknown model parameters; $L(\boldsymbol{\theta})$ is the likelihood and C is a constant (not always known) when comparing two models. The DIC criterion is then given by

$$D(\boldsymbol{\theta}) = D(\widehat{\boldsymbol{\theta}}) + 2p_D \qquad (2.4)$$

where $D(\widehat{\boldsymbol{\theta}})$ is the deviation calculated on the posterior mean $\widehat{\boldsymbol{\theta}} = \mathbb{E}(\boldsymbol{\theta} \mid y)$ and p_D is the number of model parameters, given by $p_D = \overline{D} - D(\widehat{\boldsymbol{\theta}})$ where $\overline{D} = \mathbb{E}[D(\boldsymbol{\theta} \mid y)]$ is the posterior mean of the deviation that measures the goodness of fit of the data for each model. For the conclusion, the lowest DIC values indicate the best models. DIC also could have negative values.

2.2 Change-point Detection

To detect the climate change-points we get from the generated Gibbs samples for the joint posterior distribution obtained assuming model (2.1) the Monte Carlo estimates for the contrasts $\theta_i = \mu_i - \mu_{i-1}$, where $\mu_i = \alpha_i y_{i-1} + \alpha_2 y_{i-2} + \cdots + \alpha_{J-1} y_1$, if we assume a AR(J) model in (1), where, $y_i = \log(\text{mean.temperature}_i)$. In this way, we detect a significant mean change-point in a specified year, if a 95% credible interval for θ_i does not contain the zero value (climate mean in year i is statistically different of climate mean in year $i-1$).

In the detection of year periods where the climate variable start a new behavior (could be above or below a standard climate behavior in a specified period of time), we use standard CUSUM (cumulative sum control) charts usually used in statistical quality control, which is used for monitoring change detection ([43]; [44]). The CUSUM assumed in this work considers the cumulative sum up to time i from all annual mean climate diferences in the previous years. Observe that if the climate variable do not have changes in long periods of years, in general although the great volatility of the annual mean climate variables, we should have CUSUM close to zero along all years. The purpose of cumulative sum chart (CUSUM) is to monitor the small shift in the process mean of the samples collects at a time intervals. These measurements of samples at a given time interval represents the subgroups. Instead of calculating the subgroups mean independently, the CUSUM chart represents the information of current and previous samples.

3 RESULTS

The data sets considered as illustrations of the proposed methodology consist of the temperature measures extracted from the Research Data Archive site managed by the Data Engineering Section of the Computational and Information Systems Laboratory at the National Center for Atmospheric Research, United States of America. This site contains a large and diverse collection of meteorological and oceanographic observations, (see the sites https://rda.ucar.edu/index.html?hash=data user&action=register and https://rda.ucar.edu/datasets/ ds570.0/#!subset.html, both accessed on 01 July 2021). It contains data from more than 4700 different climate stations (2600 in more recent years) from all around the world. Different follow-up periods are given for the different climate stations, and collection of data for some of them goes as far back as the mid-1700s.The primary data sets consist of monthly average temperature. Since the data sets have many missing observations (months with no information), these were replaced by the monthly averages of the available data for that month. For instance, if in a given year we have missing data for the month of January, we fill the hole in the data by assigning to that month the mean obtained using the values for the month January from all the years in which they are available. The data used in our calculations were the annual temperature averages.

As illustrative purposes for the proposed methodology, we consider the datasets from four climate stations extracted from the file ds570 of the Research Data Archive. The climate stations, observational periods, the number T of observed data are: station 30910 in Aberdeen, United Kingdom (1872-2020; T = 149); station 67000 in Geneva, Switzerland (1826-2020; T = 195), station 722080 in Charleston, USA (1832-2020; T = 189) and station 171300 in Ankara, Turkey (1826-2020; T = 195).

Fig. 1 shows the plots of the annual temperature averages for the four climate stations given in logarithm scale during their corresponding observational periods. From Figure 1, we see the possible presence of change points indicating changes from increasing/decreasing trends to decreasing/increasing and that in the final years of the follow-up periods, for each climate station, there is an indication of an increasing trend in the annual temperature averages.

For a Bayesian analysis of the AR(J) regression model (2.1), we assume independent prior distributions for the parameters $\alpha_0, \alpha_k, k = 1, 2, \cdots, J$, $\varphi = 1/\sigma^2$ that is, $\alpha_0 \sim N(0, 10), \alpha_k \sim N(0, 1), \varphi = 1/\sigma^2 \sim U(0, 1000)$, considering the four climate stations. Observe that we are assuming approximately non-informative priors for all parameters.

The posterior summaries of interest are obtained using the OpenBugs software [45]. The convergence of the MCMC algorithm was monitored using the trace-plots of the generated Gibbs samples. In the simulation process to generate the samples of the joint posterior distribution of interest, we considered initially 200,000 Gibbs samples discarded to eliminate the effect of the initial values in the iterative process and taking a final sample of size 1,000 to get the Monte Carlo estimates for each parameter (taking every 100^{th} sample of a total of 100,000 simulated samples)[46, 47, 48, 49, 50].

From the DIC discrimination criterion, we observed that AR(2) model (2.1) gives better fit (parsimony) for the annual temperature data of the four climate stations (smaller Monte Carlo estimates for DIC in all cases). The DIC values were estimated by negative values. Table 1 shows the posterior summaries (posterior mean, posterior standard deviation and 95% credible intervals) for each parameter of the assumed model.

Fig. 2 shows the scatter plots of the estimated means obtained for each fitted model togetter with the observed annual mean temperatures, from where, we observe good fit of the proposed model for the four climate data sets.

Fig. 3 shows the normality plots of the residuals used to check if the assumption of normality of the errors is verified. In general we observe that the normality assumption for the residuals are well verified for all cases. From autocorrelation plots of the residuals for the fitted models in each climate station, it was observed uncorrelated residuals. Thus the assumptions of the proposed model are satisfied in all cases.

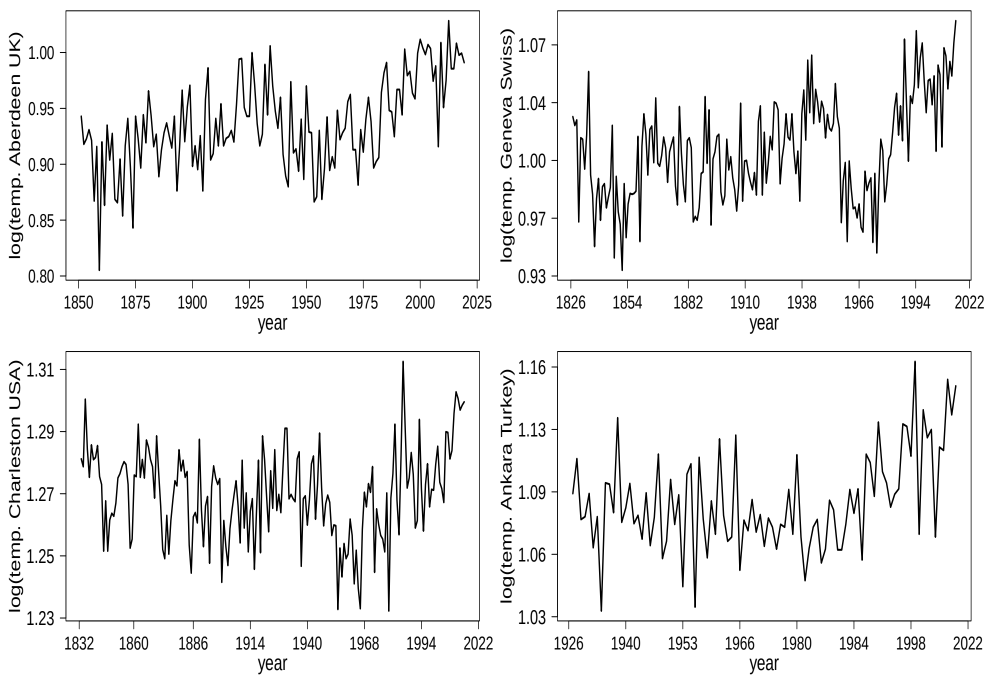

Fig. 1. Annual average temperature in the logarithmic scale (Aberdeen, Geneva, Charleston and Ankara)

Table 1. Posterior summaries (Aberdeen, Geneva, Charleston, Ankara)

2*Aberdeen	2*mean	2*sd	Lower 95%ci	Upper 95% ci
α_0	2.1040	0.0726	1.9640	2.2460
α_1	0.9014	0.0306	0.8438	0.9589
α_2	0.0990	0.0309	0.0420	0.1583
$\phi = 1/\sigma^2$	191.9000	21.7600	151.4000	237.0000
Geneva				
α_0	2.3640	0.0646	2.2410	2.4910
α_1	0.9326	0.0241	0.8873	0.9798
α_2	0.0679	0.0241	0.0220	0.1150
$\phi = i/\sigma^2$	251.2000	25.0400	206.4000	304.2000
Charleston				
α_0	2.9560	0.0333	2.8900	3.0180
α_1	0.9898	0.0277	0.9161	1.0240
α_2	0.0102	0.0113	-0.1021	0.0325
$\phi = 1/\sigma^2$	921.1000	58.2000	778.3000	997.2000
Ankara				
α_0	2.5190	0.0745	2.3690	2.6710
α_1	0.9698	0.0277	0.9161	1.0240
α_2	0.0308	0.0278	-0.0230	0.0840
$\phi = 1/\sigma^2$	187.4000	26.8100	139.8000	246.2000

From the Monte Carlo estimates for the contrasts $\theta_i = \mu_i - \mu_{i-1}$, where $\mu_i = \alpha_1 y_{i-1} + \alpha_2 y_{i-2} + \cdots + \alpha_{j-1} y_1$, where $y_i = \log(\text{mean.temperature}_i)$, we can detect the consecutive years showing the same annual mean temperatures for each climate station (95% credible interval for θ_i containing the zero value). From Tables A1, A.2, A.3 and A.4 in Appendix, the years with not significant differences between the annual mean temperatures for two consecutives years considering each assumed climate stations are the following:

- Aberdeen, UK: θ_{53} (years 1923-1924), θ_{85} (years 1955-1956), θ_{93} (years 1963-1964) and θ_{149} (years 2019-2020). All the other consecutive pairs of years have significant change in the annual mean temperatures (95% credible intervals for the associated contrasts θ does not contain the zero value).
- Geneva, Switzerland: θ_{32} (years 1856-1857), θ_{64} (years 1888-1889), θ_{105} (years 1929-1930), θ_{145} (years 1969-1970), θ_{174} (years 1998-1999), θ_{188} (years 2012-2013) and θ_{191} (years 2015-2016). All the other consecutive pairs of years have significant change in the annual mean temperatures (95% credible intervals for the associated contrasts θ does not contain the zero value).
- Charleston, USA: θ_3 (years 1833-1834), θ_{29} (years 1859-1860) and θ_{103} (years 1933-1934). All the other consecutive pairs of years have significant change in the annual mean temperatures (95% credible intervals for the associated contrasts θ does not contain the zero value).
- Ankara, Turkey: θ_3 (years 1927-1928), θ_5 (years 1929-1930), θ_{11} (years 1935-1936), θ_{68} (years 1992-1993), θ_{75} (years 1999-2000), θ_{84} (years 2008-2009) and θ_{93} (years 2017-2018). All the other consecutive pairs of years have significant change in the annual mean temperatures (95% credible intervals for the associated contrasts θ does not contain the zero value).

From these results, we observe that the proportions of pairs of years with same annual temperature are different for each climate station: 0.03356 or 3.36% (5 pairs of consecutive years in a follow-up period of 149 years) for Aberdeen, U.K.; 0.035897 or 3.59% (7 pairs of consecutive years in a follow-up period of 195 years) for Geneva, Switzerland; 0.01587 or 1.59% (3 pairs of consecutive years in a follow-up period of 189 years) for Charleston,USA and 0.07368 or 7.37% (7 pairs of consecutive years in a follow-up period of 95 years) for Ankara, Turkey.

Fig. 4 shows the graphs of CUSUM (partial sum of consecutive mean temperature differences) versus time order (Aberdeen, Geneva, Charleston and Ankara). Figure 4 shows the following behavior for each climate station:

- Aberdeen, UK: the graph of CUSUM (partial sum of consecutive mean temperature differences for two consecutive years) show a cyclic behavior (up/down) but in general there is a trend in the increasing in the CUSUM of the estimated diferences from the begining of the follow-up period until the year close to 1940 (θ_{70}); after the year 1940 there is a decreasing in the CUSUM of the estimated diferences of consecutive pairs of years until the year close to 1960 (θ_{90}); after the year 1960 we observe a increasing in CUSUM of the estimated diferences showing that the annual mean temperatures are increasing year after year until the end of the follow-up period.
- Geneva, Switzerland: the graph of CUSUM (partial sum of consecutive mean temperature differences for two consecutive years) show a cyclic behavior (up/down) but in general there is a decreasing in the CUSUM of the estimated diferences from the begining of the follow-up period until the year close to 1845 (θ_{21}); after the year 1845 there is a increasing in the CUSUM of the estimated diferences of consecutive pairs of years until the year close to 1960 (θ_{137}); after the year 1960 we observe some decreasing in the CUSUM of the estimated diferences (more stability of the annual diferences).

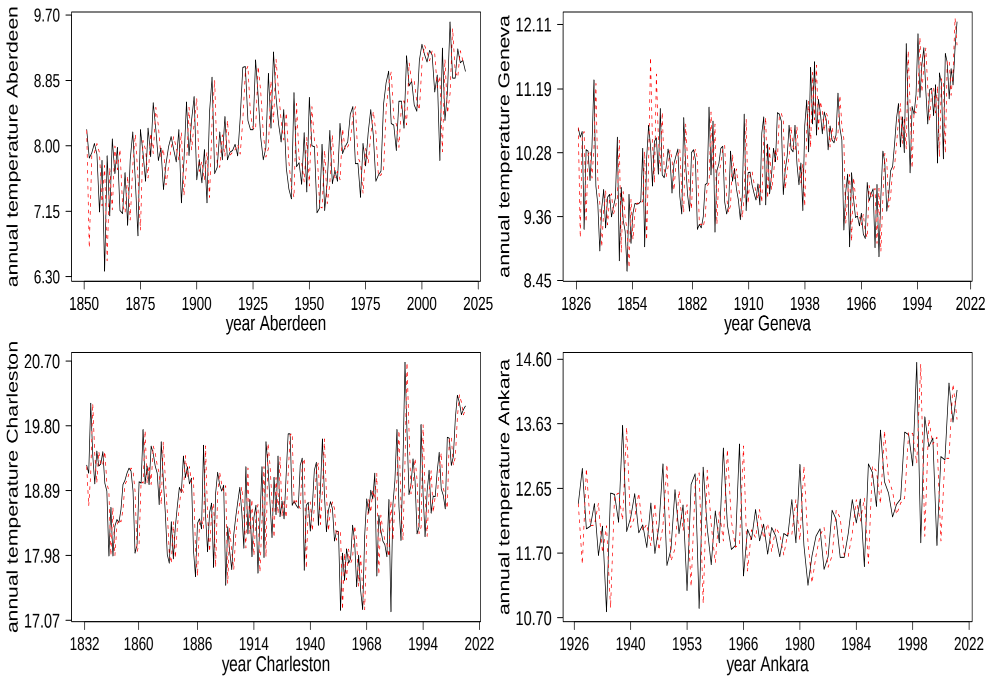

Fig. 2. Fitted and observed temperature means for the data of the four climate stations (Aberdeen, Geneva, Charleston and Ankara). Plots with dotted line associated to the fitted model.

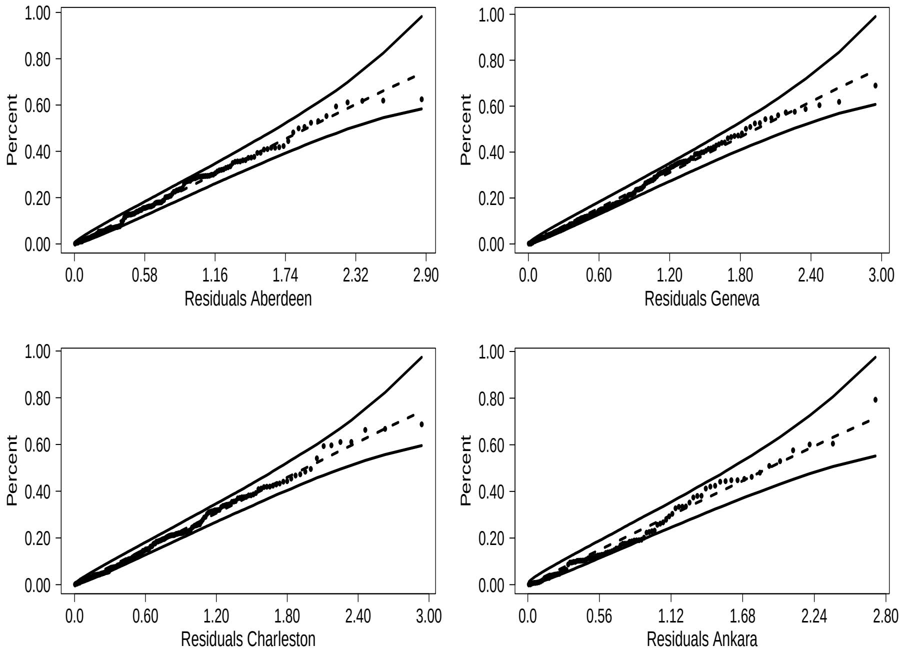

Fig. 3. Residual graphs (Aberdeen, Geneva, Charleston and Ankara).

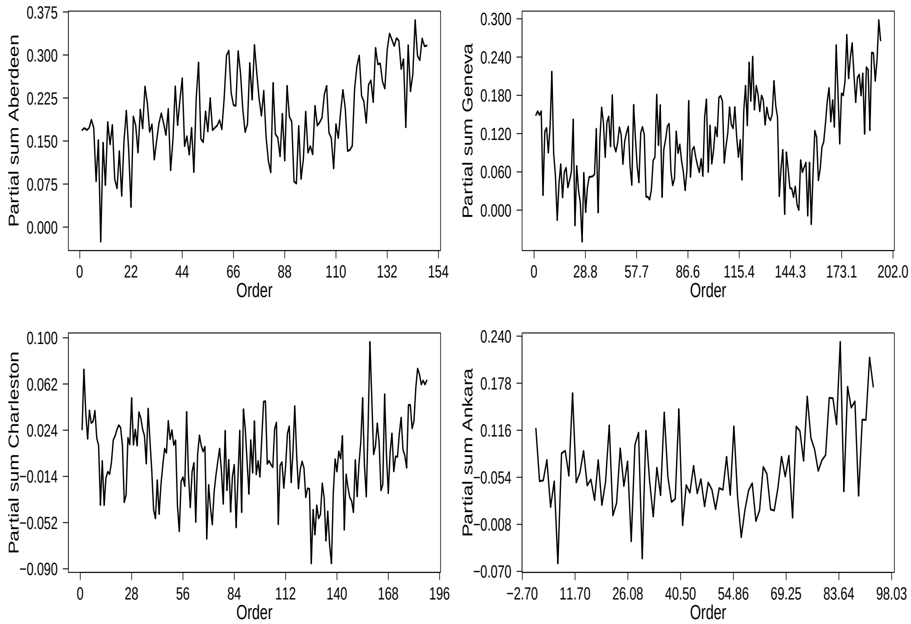

Fig. 4. Graph of CUSUM (partial sum of consecutive annual mean temperature differences) versus order (Aberdeen, Geneva, Charleston and Ankara).

- Charleston, USA: the graph of CUSUM (partial sum of consecutive mean temperature differences for two consecutive years) show a cyclic behavior (up/down) but with more stability around zero for the CUSUM of the estimated diferences from the begining of the follow-up period until the year close to 1960 (θ_{128}); after the year 1960 we observe a increasing in the CUSUM of the estimated diferences showing that the annual temperatures of the year is becoming larger to the annual mean temperature of the previous year.
- Ankara, Turkey: the graph of CUSUM (partial sum of consecutive mean temperature differences for two consecutive years) show a cyclic behavior (up/down) but with more stability around zero for the CUSUM of the estimated diferences from the begining of the follow-up period until the year close to 1995 (θ_{70}); after the year 1995 we observe a increasing in the CUSUM of the estimated diferences showing that the annual temperatures of the year is becoming larger to the annual mean temperature of the previous year.

4 CONCLUSION

Climate changes (temperature, rainfall, etc.) have been observed all over the world. As these climate changes can have different effects in diferents locations, the detection of times when changes occur is of great interest to all. The modeling of climate time series has been considered in different ways, as observed in the literature. In this study, we assumed a simple model based on an auto-regressive structure, which in addition to leading to a good fit to the data, it was also possible to detect from the adjusted model, significant differences between consecutive annual averages of two years and long periods where it was observed a sharp change in mean annual temperatures in different weather seasons using usual CUSUM control charts usually used in industrial statistical control. The results obtained are simple to be reproduced for any climate series especially under a Bayesian approach using MCMC methods to generate samples of the joint posterior distribution for the parameters of the proposed model. It is important to point out that two-by-two comparisons for the climatic averages in two consecutive years are obtained simultaneously with the simulation of the Gibbs samples. These results can be of great interest in the study of the climatic changes observed throughout the planet.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

[1] Nrc. America's Climate Choices. National Academies Press; 2011.

[2] Noaa N. State of the climate: Global climate report for annual 2018. URL www ncdc noaa gov/sotc/global/201813. Published online 2019.

[3] Ipcc. Report of the nineteenth session of the intergovernmental panel on climate change (IPCC) Geneva, 17-20 (am only) April 2002. Published online 2007.

[4] Ipcc. Technical summary. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press; 2013:33-115.

[5] Arnell NW, Lloyd-Hughes B. The global-scale impacts of climate change on water resources and flooding under new climate and socio-economic scenarios. Climatic change. 2014;122(1):127-140.

[6] Costello A, Abbas M, Allen A, et al. Managing the health effects of climate change: lancet and University College London Institute for Global Health Commission. The lancet. 2009;373(9676):1693-1733.

[7] Hawkins E, Ortega P, Suckling E, et al. Estimating changes in global temperature since the preindustrial period. Bulletin of the American Meteorological Society. 2017;98(9):1841-1856.

[8] Lineman M, Do Y, Kim JY, Joo GJ. Talking about climate change and global warming. PloS one. 2015;10(9):e0138996.

[9] Kabir R, Khan HTA, Ball E, Caldwell K. Climate change impact: the experience of the coastal areas of Bangladesh affected by cyclones Sidr and Aila. Journal of environmental and public health. 2016;2016.

[10] Levermann A, Clark PU, Marzeion B, et al. The multimillennial sea-level commitment of global warming. Proceedings of the National Academy of Sciences. 2013;110(34):13745-13750.

[11] Kaczan DJ, Orgill-Meyer J. The impact of climate change on migration: a synthesis of recent empirical insights. Climatic Change. 2020;158(3):281-300.

[12] Matthews T. Humid heat and climate change. Progress in Physical Geography: Earth and Environment. 2018;42(3):391-405.

[13] Poloczanska ES, Brown CJ, Sydeman WJ, et al. Global imprint of climate change on marine life. Nature Climate Change. 2013;3(10):919-925.

[14] Serdeczny O, Adams S, Baarsch F, et al. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions. Regional Environmental Change. 2017;17(6):1585-1600.

[15] Springmann M, Mason-D'Croz D, Robinson S, et al. Global and regional health effects of future food production under climate change: a modelling study. The Lancet. 2016;387(10031):1937-1946.

[16] Turner MG, Calder WJ, Cumming GS, et al. Climate change, ecosystems and abrupt change: science priorities. Philosophical Transactions of the Royal Society B. 2020;375(1794):20190105.

[17] Zhao C, Liu B, Piao S, et al. Temperature increase reduces global yields of major crops in four independent estimates. Proceedings of the National Academy of Sciences. 2017;114(35):9326-9331.

[18] Richards GR. Change in global temperature: a statistical analysis. Journal of Climate. 1993;6(3):546-559.

[19] Alexander et.al LV. Global observed changes in daily climate extremes of temperature and precipitation. Journal of Geophysical Research. 2006;111.

[20] Tebaldi C, Sansó B. Joint projections of temperature and precipitation change from multiple climate models: a hierarchical Bayesian approach. Journal of the Royal Statistical Society: Series A (Statistics in Society). 2009;172(1):83-106.

[21] Powell B. Statistical Modelling of Climate Change. In: Climate Change. Elsevier; 2016:341-354.

[22] Diaz-Nieto J, Wilby RL. A comparison of statistical downscaling and climate change factor methods: impacts on low flows in the River Thames, United Kingdom. Climatic Change. 2005;69(2):245-268.

[23] Ribes A, Zwiers FW, Azais JM, Naveau P. A new statistical approach to climate change detection and attribution. Climate Dynamics. 2017;48(1):367-386.

[24] Vanem E. Joint statistical models for significant wave height and wave period in a changing climate. Marine Structures. 2016;49:180-205.

[25] Barry D, Hartigan JA. A Bayesian analysis for change point problems. Journal of the American Statistical Association. 1993;88(421):309-319.

[26] Carlin BP, Gelfand AE, Smith AFM. Hierarchical Bayesian analysis of changepoint problems. Journal of the royal statistical society: series C (applied statistics). 1992;41(2):389-405.

[27] Robbins MW, Gallagher CM, Lund RB. A general regression changepoint test for time series data. Journal of the American Statistical Association. 2016;111(514):670-683.

[28] Gallagher C, Lund R, Robbins M. Changepoint detection in daily precipitation data. Environmetrics. 2012;23(5):407-419.

[29] Li S, Lund R. Multiple changepoint detection via genetic algorithms. Journal of Climate. 2012;25(2):674-686.

[30] Achcar JA, Bolfarine H. Constant hazard against a change-point alternative: a Bayesian approach with censored data. Communications in Statistics-Theory and Methods. 1989;18(10):3801-3819.

[31] Bacon DW, Watts DG. Estimating the transition between two intersecting straight lines. Biometrika. 1971;58(3):525-534.

[32] Ferreira PE. A Bayesian analysis of a switching regression model: known number of regimes. Journal of the American Statistical Association. 1975;70(350):370-374.

[33] Gelfand AE, Smith AFM. Sampling-based approaches to calculating marginal densities. Journal of the American statistical association. 1990;85(410):398-409.

[34] Gelman A, Carlin JB, Stern HS, Rubin DB. Bayesian Data Analysis. Chapman and Hall/CRC; 1995.

[35] Bell WR. An introduction to forecasting with time series models. Insurance: Mathematics and Economics. 1984;3(4):241-255.

[36] Box GEP, Jenkins, Reinsel GC. Time Series Analysis: Forecasting and Control. John Wiley Sons; 1994.

[37] Montgomery DC, Jennings CL, Kulahci M. Introduction to Time Series Analysis and Forecasting, A John Wiley Sons. Inc , New Jersey. Published online 2008.

[38] Box GEP, Tiao GC. Bayesian inference in statistical analysis, addision-wesley. Reading, MA. Published online 1973.

[39] Chib S, Greenberg E. Understanding the metropolis-hastings algorithm. The american statistician. 1995;49(4):327-335.

[40] Lunn DJ, Thomas A, Best N, Spiegelhalter D. WinBUGS-a Bayesian modelling framework: concepts, structure, and extensibility. Statistics and computing. 2000;10(4):325-337.

[41] Bernardo JM, Smith AFM. Bayesian Theory. Vol 405. John Wiley & Sons; 2009.

[42] Spiegelhalter DJ, Best NG, Carlin BP, Van Der Linde A. Bayesian measures of model complexity and fit. Journal of the royal statistical society: Series b (statistical methodology). 2002;64(4):583-639.

[43] Grigg OA, Farewell VT, Spiegelhalter DJ. Use of risk-adjusted CUSUM and RSPRTcharts for monitoring in medical contexts. Statistical methods in medical research. 2003;12(2):147-170.

[44] Barnard GA. Control charts and stochastic processes. Journal of the Royal Statistical Society: Series B (Methodological). 1959;21(2):239-257.

[45] Spiegelhalter D, Thomas A, Best N, Lunn D. OpenBUGS user manual. Version. 2007;3(2):2007.

[46] Staffini A, Svensson T, Chung UI, Svensson AK. Heart rate modeling and prediction using autoregressive models and deep learning. Sensors. 2022;22(1):34.

[47] Liu Y, Mao C, Leiva V, Liu S, Silva Neto WA. Asymmetric autoregressive models: Statistical aspects and a financial application under COVID-19 pandemic. Journal of Applied Statistics. 2022;49(5):1323-1347.

[48] Feng H, Yan H. State of health estimation of large-cycle lithium-ion batteries based on error compensation of autoregressive model. Journal of Energy Storage. 2022;52:104869.

[49] Guo T, Song S, Yan Y. A time-varying autoregressive model for groundwater depth prediction. Journal of Hydrology. 2022;613:128394.

[50] Liu B, Jia N, Huang J, Guo S, Xiao D, Ma L. Autoregressive model of an underwater acoustic channel in the frequency domain. Applied Acoustics. 2022;185:108397.

APPENDIX

Table A.1 (Aberdeen, UK)

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
α_0	2.104	0.07262	0.002151	1.964	2.103	2.246	2001	1000
α_1	0.9014	0.03057	0.001401	0.8438	0.9001	0.9589	2001	1000
α_2	0.09904	0.03086	0.001402	0.04202	0.1007	0.1583	2001	1000
τ	191.9	21.76	0.6407	151.4	191.0	237.0	2001	1000
θ_3	0.1669	0.06637	0.003017	0.0443	0.1703	0.2944	2001	1000
θ_4	0.003446	0.001694	7.71E-5	0.2655	0.003372	0.006628	2001	1000
θ_5	0.01445	1.89E-4	0.008692	0.0141	0.01444	0.01482	2001	1000
θ_6	-0.01436	0.001001	0.04574	-0.01622	-0.01432	-0.01244	2001	1000
θ_7	-0.09178	0.002514	0.1154	-0.09652	-0.09164	-0.08701	2001	1000
θ_8	0.07096	0.005817	0.2656	0.06018	0.07069	0.08182	2001	1000
θ_9	-0.1748	0.008989	0.4112	-0.1915	-0.1744	-0.1577	2001	1000
θ_{10}	0.1704	0.01274	0.5819	0.1468	0.1699	0.1942	2001	1000
θ_{11}	-0.07314	0.009706	0.4426	-0.09108	-0.07273	-0.05441	2001	1000
θ_{12}	0.1086	0.007246	0.3311	0.09513	0.1083	0.1221	2001	1000
θ_{13}	-0.03852	0.005815	0.2651	-0.04927	-0.03827	-0.0273	2001	1000
θ_{14}	0.03358	0.003094	0.1412	0.02786	0.03344	0.03936	2001	1000
θ_{15}	-0.09343	0.004654	0.2129	-0.1021	-0.09323	-0.08457	2001	1000
θ_{16}	-0.01579	0.003175	0.1442	-0.02185	-0.01595	-0.009801	2001	1000
θ_{17}	0.06417	0.002367	0.1085	0.05971	0.06407	0.0686	2001	1000
θ_{18}	-0.07719	0.005069	0.2316	-0.08659	-0.07696	-0.06744	2001	1000
θ_{19}	0.09485	0.006409	0.2929	0.08294	0.09461	0.1068	2001	1000
θ_{20}	0.05201	0.002198	0.09906	0.04789	0.05209	0.05626	2001	1000
θ_{21}	-0.06779	0.003835	0.1754	-0.07492	-0.06762	-0.06043	2001	1000
θ_{22}	-0.09828	0.6457	0.02907	-0.09955	-0.09827	-0.09704	2001	1000
θ_{23}	0.156	0.008709	0.3983	0.1397	0.1556	0.1722	2001	1000
θ_{24}	-0.01533	0.006812	0.3101	-0.02792	-0.01501	-0.00221	2001	1000
θ_{25}	-0.04687	0.3388	0.01535	-0.04752	-0.04687	-0.04622	2001	1000
θ_{26}	0.07419	0.004151	0.1898	0.06642	0.07401	0.08191	2001	1000
θ_{27}	-0.03279	0.004104	0.1872	-0.04038	-0.03262	-0.02488	2001	1000
θ_{28}	0.07235	0.004023	1.84E-4	0.06482	0.07218	0.07983	2001	1000
θ_{29}	-0.02809	0.003868	0.1764	-0.03523	-0.02792	-0.02062	2001	1000
θ_{30}	-0.05014	0.3403	0.01536	-0.05079	-0.05013	-0.04948	2001	1000
θ_{31}	0.01321	0.002197	0.1001	0.009128	0.01312	0.01733	2001	1000
θ_{32}	-0.06087	0.002756	0.1262	-0.06598	-0.06076	-0.05566	2001	1000
θ_{33}	0.03271	0.003492	0.1593	0.02626	0.03257	0.03925	2001	1000
θ_{34}	0.02987	0.5017	0.02216	0.02892	0.02988	0.03085	2001	1000
θ_{35}	0.01735	0.3852	0.01717	0.01663	0.01737	0.0181	2001	1000
θ_{36}	-0.01747	0.001144	0.05226	-0.0196	-0.01742	-0.01527	2001	1000
θ_{37}	-0.02019	7.17E-5	0.002308	-0.02033	-0.02019	-0.02005	2001	1000
θ_{38}	0.04512	0.002215	0.1013	0.04095	0.04503	0.04924	2001	1000
θ_{39}	-0.1057	0.005367	0.2455	-0.1156	-0.1054	-0.09545	2001	1000
θ_{40}	0.05249	0.005982	0.2729	0.04145	0.05224	0.06369	2001	1000
θ_{41}	0.09197	0.7058	0.03209	0.09061	0.09196	0.09337	2001	1000
θ_{42}	-0.06691	0.005484	0.2504	-0.07706	-0.06666	-0.05635	2001	1000
θ_{43}	0.04334	0.004359	0.1989	0.03528	0.04315	0.05149	2001	1000
θ_{44}	0.03754	0.7024	0.03114	0.03621	0.03757	0.03891	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{45}	-0.1169	0.005169	0.2366	-0.1264	-0.1167	-0.1071	2001	1000
θ_{46}	0.01726	0.00515	0.2346	0.007615	0.01703	0.02692	2001	1000
θ_{47}	-0.03191	0.002237	0.1022	-0.03606	-0.03181	-0.02761	2001	1000
θ_{48}	0.04625	0.002904	0.1327	0.04084	0.04614	0.05166	2001	1000
θ_{49}	-0.07633	0.004487	0.2051	-0.08467	-0.07614	-0.06771	2001	1000
θ_{50}	0.127	0.007405	0.3386	0.1132	0.1267	0.1408	2001	1000
θ_{51}	0.06175	0.003078	0.1389	0.05594	0.06186	0.06772	2001	1000
θ_{52}	-0.1317	0.006236	0.2854	-0.1432	-0.1314	-0.1198	2001	1000
θ_{53}	-0.00564	0.005	0.2274	-0.0151	-0.005878	0.00377	2001	1000
θ_{54}	0.0532	0.00145	0.06654	0.0505	0.05313	0.05601	2001	1000
θ_{55}	-0.03484	0.003158	0.1442	-0.04068	-0.0347	-0.02875	2001	1000
θ_{56}	0.05789	0.003499	1.6E-4	0.05136	0.05775	0.0644	2001	1000
θ_{57}	-0.0555	0.004244	0.1938	-0.06335	-0.0553	-0.04733	2001	1000
θ_{58}	0.004263	0.00251	0.1142	-0.4533	0.004152	0.008978	2001	1000
θ_{59}	0.003836	0.2922	0.01323	0.00329	0.003847	0.004403	2001	1000
θ_{60}	0.009324	0.2175	0.009993	0.008915	0.009314	0.009742	2001	1000
θ_{61}	-0.01603	0.8856	4.05E-5	-0.01767	-0.01599	-0.01433	2001	1000
θ_{62}	0.05365	0.002464	0.1128	0.04901	0.05356	0.05825	2001	1000
θ_{63}	0.07352	0.4333	1.93E-5	0.07269	0.07351	0.07438	2001	1000
θ_{64}	0.008406	0.002274	0.1033	0.004204	0.00853	0.01277	2001	1000
θ_{65}	-0.07262	0.002501	0.1146	-0.07732	-0.07251	-0.0679	2001	1000
θ_{66}	-0.02107	0.002049	0.09285	-0.02499	-0.02116	-0.0172	2001	1000
θ_{67}	-0.001437	0.4478	0.02035	-0.002288	-0.00146	-0.5935	2001	1000
θ_{68}	0.09446	0.003203	0.1469	0.08842	0.09432	0.1005	2001	1000
θ_{69}	-0.03702	0.004836	0.2205	-0.04596	-0.03682	-0.02769	2001	1000
θ_{70}	-0.06331	0.3871	0.01731	-0.06408	-0.06331	-0.06257	2001	1000
θ_{71}	-0.03921	0.8873	0.03956	-0.04093	-0.03923	-0.03751	2001	1000
θ_{72}	0.01352	0.001703	0.07765	0.01037	0.01345	0.01671	2001	1000
θ_{73}	0.1056	0.002935	0.1347	0.1001	0.1055	0.1113	2001	1000
θ_{74}	-0.0634	0.006081	0.2775	-0.07463	-0.06313	-0.05168	2001	1000
θ_{75}	0.09417	0.006026	0.2754	0.08296	0.09396	0.1054	2001	1000
θ_{76}	-0.04836	0.005521	0.2518	-0.05856	-0.04813	-0.03771	2001	1000
θ_{77}	-0.04387	0.7899	0.03498	-0.0454	-0.0439	-0.04236	2001	1000
θ_{78}	-0.02949	0.4281	0.01879	-0.03033	-0.0295	-0.02867	2001	1000
θ_{79}	0.04305	0.002421	0.1107	0.03853	0.04295	0.04756	2001	1000
θ_{80}	-0.07971	0.004439	2.03E-4	-0.08796	-0.07952	-0.0712	2001	1000
θ_{81}	-0.04144	0.001819	0.08201	-0.04492	-0.04151	-0.03799	2001	1000
θ_{82}	-0.01942	0.5659	0.02537	-0.02051	-0.01944	-0.01834	2001	1000
θ_{83}	0.1541	0.005828	2.67E-4	0.1432	0.1539	0.165	2001	1000
θ_{84}	-0.0884	0.008905	0.4064	-0.1049	-0.08801	-0.07123	2001	1000
θ_{85}	-0.005782	0.003809	0.1732	-0.01299	-0.005966	0.001387	2001	1000
θ_{86}	-0.0324	0.001319	6.04E-5	-0.03484	-0.03235	-0.0299	2001	1000
θ_{87}	0.0735	0.003743	0.1712	0.06647	0.07335	0.08047	2001	1000
θ_{88}	-0.08076	0.00566	0.2586	-0.09125	-0.0805	-0.06987	2001	1000
θ_{89}	0.1288	0.007747	0.3541	0.1144	0.1285	0.1432	2001	1000
θ_{90}	-0.0531	0.007055	0.3217	-0.06614	-0.05281	-0.03949	2001	1000
θ_{91}	-0.008635	0.002301	0.1045	-0.01301	-0.008752	-0.004298	2001	1000
θ_{92}	-0.1028	0.003443	0.1578	-0.1092	-0.1026	-0.09628	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{93}	-0.003725	0.003769	0.1714	-0.01085	-0.003901	0.003368	2001	1000
θ_{94}	0.09931	0.003082	0.1414	0.09353	0.09919	0.1052	2001	1000
θ_{95}	-0.09143	0.006831	3.12E-4	-0.1041	-0.09111	-0.07828	2001	1000
θ_{96}	0.03418	0.005036	0.2296	0.02484	0.03397	0.04362	2001	1000
θ_{97}	0.08183	0.001068	0.04912	0.07984	0.08178	0.0839	2001	1000
θ_{98}	-0.07079	0.005311	0.2426	-0.08063	-0.07055	-0.06057	2001	1000
θ_{99}	0.01147	0.003394	0.1546	0.00512	0.01133	0.01784	2001	1000
θ_{100}	-0.01437	0.001252	0.05714	-0.01668	-0.01431	-0.01196	2001	1000
θ_{101}	0.08366	0.003464	0.1587	0.07716	0.08353	0.09013	2001	1000
θ_{102}	-0.03405	0.004395	0.2004	-0.04217	-0.03386	-0.02557	2001	1000
θ_{103}	0.005439	0.001832	0.08342	0.002007	0.005363	0.008879	2001	1000
θ_{104}	0.007866	0.1238	0.005454	0.007629	0.007869	0.008109	2001	1000
θ_{105}	0.04018	0.001108	0.05085	0.03811	0.04012	0.04232	2001	1000
θ_{106}	0.01499	0.9909	0.04482	0.01313	0.01502	0.01691	2001	1000
θ_{107}	-0.08083	0.003144	1.44E-4	-0.08666	-0.0807	-0.07485	2001	1000
θ_{108}	-0.00901	0.002807	0.1276	-0.01435	-0.009152	-0.003721	2001	1000
θ_{109}	-0.05255	0.001782	8.17E-5	-0.05589	-0.05247	-0.04918	2001	1000
θ_{110}	0.07644	0.004582	0.2095	0.0679	0.07626	0.08497	2001	1000
θ_{111}	-0.02412	0.003935	0.1794	-0.0314	-0.02394	-0.01653	2001	1000
θ_{112}	0.04509	0.002785	0.1273	0.03991	0.04499	0.05028	2001	1000
θ_{113}	0.03786	0.5804	0.02554	0.03675	0.03788	0.039	2001	1000
θ_{114}	-0.03225	0.002325	0.1062	-0.03656	-0.03214	-0.02778	2001	1000
θ_{115}	-0.07296	0.001126	0.05179	-0.07512	-0.0729	-0.07084	2001	1000
θ_{116}	0.001931	0.002684	0.1221	-0.003125	0.001809	0.006977	2001	1000
θ_{117}	0.006941	0.1281	0.005676	0.006699	0.006946	0.00719	2001	1000
θ_{118}	0.0975	0.003084	0.1414	0.09171	0.09737	0.1034	2001	1000
θ_{119}	0.03972	0.002336	0.1056	0.03533	0.0398	0.04426	2001	1000
θ_{120}	0.0184	0.4848	0.02169	0.01748	0.01841	0.01934	2001	1000
θ_{121}	-0.06939	0.002928	0.1341	-0.07482	-0.06929	-0.06384	2001	1000
θ_{122}	-0.009985	0.002359	0.1072	-0.01448	-0.01011	-0.005538	2001	1000
θ_{123}	-0.03695	0.001171	0.05369	-0.03915	-0.0369	-0.03473	2001	1000
θ_{124}	0.06585	0.003623	0.1657	0.05907	0.06569	0.07258	2001	1000
θ_{125}	0.007678	0.002392	0.1087	0.003257	0.007805	0.01227	2001	1000
θ_{126}	-0.03754	0.001273	0.05837	-0.03993	-0.03748	-0.03514	2001	1000
θ_{127}	0.09337	0.004587	0.2099	0.08474	0.09318	0.1019	2001	1000
θ_{128}	-0.02847	0.004662	0.2125	-0.03708	-0.02824	-0.01947	2001	1000
θ_{129}	0.001835	0.001548	0.07047	-0.001079	0.001764	0.004745	2001	1000
θ_{130}	-0.0315	0.001301	0.05956	-0.03391	-0.03145	-0.02904	2001	1000
θ_{131}	-0.01203	0.8152	0.03688	-0.01358	-0.01206	-0.01049	2001	1000
θ_{132}	0.06686	0.002589	0.1186	0.062	0.06675	0.0717	2001	1000
θ_{133}	0.02799	0.001629	0.07359	0.02493	0.02805	0.03115	2001	1000
θ_{134}	-0.0104	0.001131	0.05162	-0.0125	-0.01036	-0.008223	2001	1000
θ_{135}	-0.01125	0.1054	0.004484	-0.01146	-0.01125	-0.01105	2001	1000
θ_{136}	0.01367	8.37E-4	0.03826	0.01211	0.01364	0.01523	2001	1000
θ_{137}	-0.004251	0.7036	0.03207	-0.005552	-0.004217	-0.002894	2001	1000
θ_{138}	-0.04906	0.001442	0.06615	-0.05177	-0.04898	-0.04633	2001	1000
θ_{139}	0.01719	0.002418	0.1103	0.01271	0.01709	0.02172	2001	1000
θ_{140}	-0.1173	0.00483	0.2212	-0.1263	-0.1171	-0.1082	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{141}	0.1413	0.009329	0.4263	0.124	0.141	0.1587	2001	1000
θ_{142}	-0.07941	0.008548	3.9E-4	-0.0952	-0.07904	-0.06293	2001	1000
θ_{143}	0.02962	0.004659	0.2124	0.02097	0.02942	0.03835	2001	1000
θ_{144}	0.09306	0.001641	0.07547	0.08999	0.09298	0.09621	2001	1000
θ_{145}	-0.06148	0.005443	0.2485	-0.07154	-0.06123	-0.05099	2001	1000
θ_{146}	-0.007824	0.002438	0.1108	-0.01246	-0.007948	-0.003231	2001	1000
θ_{147}	0.03777	0.001281	0.05873	0.03536	0.03772	0.04018	2001	1000
θ_{148}	-0.01354	0.001891	0.08623	-0.01704	-0.01346	-0.009895	2001	1000
θ_{149}	0.001029	0.7062	0.03214	-0.2985	0.9976	0.002356	2001	1000

Table A.2 (Geneva,Switzerland)

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
α_0	2.364	0.06457	0.002022	2.241	2.366	2.491	2001	1000
α_1	0.9326	0.02413	0.00125	0.8873	0.932	0.9798	2001	1000
α_2	0.06788	0.02411	0.001247	0.02198	0.06841	0.115	2001	1000
τ	251.2	25.04	0.8469	206.4	251.5	304.2	2001	1000
θ_3	0.149	0.05728	0.002963	0.0399	0.1502	0.261	2001	1000
θ_4	0.006243	4,79E-01	2,48E-02	0.005323	0.006234	0.007166	2001	1000
θ_5	-0.1319	0.003608	1,87E-01	-0.1388	-0.1318	-0.125	2001	1000
θ_6	0.09953	0.006241	3,23E-01	0.08754	0.0994	0.1116	2001	1000
θ_7	0.006137	0.002869	1,48E-01	6,73E-01	0.006195	0.01174	2001	1000
θ_8	-0.03896	9,58E-01	4,96E-02	-0.04081	-0.03894	-0.03716	2001	1000
θ_9	0.04141	0.002147	1,11E-01	0.0373	0.04137	0.04557	2001	1000
θ_{10}	0.08586	0.001004	5.18E-5	0.08396	0.08586	0.08788	2001	1000
θ_{11}	-0.1284	0.005611	2,91E-01	-0.1392	-0.1283	-0.1177	2001	1000
θ_{12}	-0.03486	0.00283	1,46E-01	-0.04042	-0.03488	-0.02947	2001	1000
θ_{13}	-0.06973	0.001113	5,76E-02	-0.07195	-0.06972	-0.06763	2001	1000
θ_{14}	0.05708	0.003358	1,74E-01	0.05064	0.05701	0.06357	2001	1000
θ_{15}	0.0307	9,30E-01	4,79E-02	0.02893	0.03071	0.03256	2001	1000
θ_{16}	-0.05224	0.002077	1,08E-01	-0.05622	-0.0522	-0.04827	2001	1000
θ_{17}	0.03963	0.002525	1,31E-01	0.03478	0.03957	0.0445	2001	1000
θ_{18}	0.007033	0.001027	5,31E-02	0.005078	0.007049	0.009051	2001	1000
θ_{19}	-0.03107	9,11E-01	4,72E-02	-0.03282	-0.03104	-0.02934	2001	1000
θ_{20}	0.01156	0.001168	6,05E-02	0.009315	0.01154	0.01381	2001	1000
θ_{21}	0.01368	4,14E-02	1,73E-03	0.0136	0.01368	0.01376	2001	1000
θ_{22}	0.08158	0.001761	9,12E-02	0.0783	0.08156	0.08506	2001	1000
θ_{23}	-0.1663	0.006535	3,39E-01	-0.1788	-0.1661	-0.1538	2001	1000
θ_{24}	0.09338	0.007185	3,72E-01	0.0796	0.09325	0.1072	2001	1000
θ_{25}	-0.03822	0.003924	2,03E-01	-0.04572	-0.03814	-0.03063	2001	1000
θ_{26}	-0.01951	7,71E-01	3,98E-02	-0.02102	-0.01951	-0.01804	2001	1000
θ_{27}	-0.06116	0.001136	5,89E-02	-0.06341	-0.06114	-0.05902	2001	1000
θ_{28}	0.1081	0.004458	2.31E-4	0.09959	0.108	0.1167	2001	1000
θ_{29}	-0.06181	0.004716	2,44E-01	-0.07083	-0.06172	-0.0527	2001	1000
θ_{30}	0.03852	0.002936	1.52E-4	0.03289	0.03847	0.04418	2001	1000
θ_{31}	0.01695	7.73E-4	3,99E-02	0.01548	0.01695	0.01847	2001	1000
θ_{32}	2,55E-02	3,81E-01	1,97E-02	-7.01E-4	3,32E-02	7,68E-01	2001	1000
θ_{33}	9,06E-01	5.05E-5	2,62E-03	8,09E-01	9,05E-01	0.001004	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{34}	0.002996	5,06E-02	2,62E-03	0.002901	0.002995	0.003097	2001	1000
θ_{35}	0.07141	0.001767	9,16E-02	0.0681	0.07137	0.07488	2001	1000
θ_{36}	-0.1315	0.005374	2,78E-01	-0.1418	-0.1314	-0.1212	2001	1000
θ_{37}	0.1141	0.006737	3.49E-4	0.1011	0.1139	0.1271	2001	1000
θ_{38}	0.05104	0.002124	1,10E-01	0.04699	0.05104	0.05524	2001	1000
θ_{39}	-0.02354	0.001773	9,18E-02	-0.02693	-0.0235	-0.02011	2001	1000
θ_{40}	-0.05466	6,82E-01	3,52E-02	-0.05603	-0.05465	-0.05335	2001	1000
θ_{41}	0.05516	0.002887	1,50E-01	0.04962	0.0551	0.06075	2001	1000
θ_{42}	0.00875	0.00141	7,29E-02	0.006065	0.008772	0.01152	2001	1000
θ_{43}	-0.04709	0.001342	6,95E-02	-0.04967	-0.04705	-0.04455	2001	1000
θ_{44}	0.08057	0.003397	1.76E-4	0.07406	0.0805	0.08713	2001	1000
θ_{45}	-0.07884	0.004367	2,26E-01	-0.0872	-0.07874	-0.07045	2001	1000
θ_{46}	-0.009937	0.002099	1,09E-01	-0.01404	-0.00997	-0.00592	2001	1000
θ_{47}	0.01372	4,59E-01	2,38E-02	0.01285	0.01371	0.01461	2001	1000
θ_{48}	0.02479	2,56E-01	1,32E-02	0.02431	0.02479	0.02531	2001	1000
θ_{49}	-0.01191	9,67E-01	5,01E-02	-0.01376	-0.01189	-0.01004	2001	1000
θ_{50}	-0.04603	8,15E-01	4,22E-02	-0.04765	-0.04603	-0.0445	2001	1000
θ_{51}	0.03625	0.002185	1,13E-01	0.03205	0.03621	0.04047	2001	1000
θ_{52}	0.01296	7,62E-01	3,94E-02	0.01151	0.01297	0.01447	2001	1000
θ_{53}	0.009806	3,31E-02	1,45E-03	0.009743	0.009806	0.009869	2001	1000
θ_{54}	-0.06284	0.001877	9,73E-02	-0.06644	-0.06279	-0.05928	2001	1000
θ_{55}	-0.0291	0.001012	5,21E-02	-0.03107	-0.02909	-0.02717	2001	1000
θ_{56}	0.126	0.003937	2.04E-4	0.1185	0.1259	0.1336	2001	1000
θ_{57}	-0.05146	0.004871	2,52E-01	-0.06077	-0.05138	-0.04203	2001	1000
θ_{58}	-0.045	5,32E-01	2,70E-02	-0.04601	-0.045	-0.04395	2001	1000
θ_{59}	-0.0254	4,72E-01	2,42E-02	-0.02631	-0.0254	-0.02449	2001	1000
θ_{60}	0.07786	0.002636	1,37E-01	0.07285	0.07781	0.08294	2001	1000
θ_{61}	0.009408	0.001962	1,01E-01	0.005675	0.009448	0.01325	2001	1000
θ_{62}	-0.01247	4.23E-4	2,19E-02	-0.01329	-0.01246	-0.01167	2001	1000
θ_{63}	-0.09735	0.002167	1,12E-01	-0.1016	-0.09731	-0.09329	2001	1000
θ_{64}	6,51E-02	0.002675	1,38E-01	-0.00512	2.01E-5	0.005182	2001	1000
θ_{65}	-0.004539	3,14E-01	1,63E-02	-0.005139	-0.004533	-0.003934	2001	1000
θ_{66}	0.01571	5,46E-01	2,83E-02	0.01467	0.0157	0.01676	2001	1000
θ_{67}	0.04591	7,44E-01	3,85E-02	0.04451	0.0459	0.04739	2001	1000
θ_{68}	0.005154	0.001108	5,73E-02	0.003046	0.005177	0.007325	2001	1000
θ_{69}	0.09811	0.002486	1,29E-01	0.09345	0.09805	0.103	2001	1000
θ_{70}	-0.07954	0.004771	2,47E-01	-0.08866	-0.07942	-0.07037	2001	1000
θ_{71}	0.06314	0.004034	2,09E-01	0.05539	0.06305	0.07092	2001	1000
θ_{72}	-0.1445	0.005661	2,93E-01	-0.1554	-0.1444	-0.1337	2001	1000
θ_{73}	0.07484	0.00608	3,15E-01	0.06318	0.07473	0.08653	2001	1000
θ_{74}	0.0155	0.001977	1,02E-01	0.01174	0.01553	0.01939	2001	1000
θ_{75}	0.02073	2,81E-01	1,45E-02	0.0202	0.02073	0.0213	2001	1000
θ_{76}	0.004162	4,49E-01	2.32E-5	0.003307	0.004168	0.005046	2001	1000
θ_{77}	-0.07467	0.002007	1.04E-4	-0.07854	-0.07462	-0.07089	2001	1000
θ_{78}	-0.02216	0.001505	7,77E-02	-0.02511	-0.02217	-0.0193	2001	1000
θ_{79}	0.01061	7,38E-01	3.82E-5	0.009197	0.0106	0.01203	2001	1000
θ_{80}	0.0743	0.001596	8,27E-02	0.07133	0.07428	0.07746	2001	1000
θ_{81}	-0.03442	0.002925	1,52E-01	-0.04001	-0.03437	-0.02876	2001	1000
θ_{82}	0.01396	0.001463	7,58E-02	0.01114	0.01393	0.01677	2001	1000
θ_{83}	-0.02608	0.001141	5,91E-02	-0.02827	-0.02605	-0.02389	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{84}	-0.0174	3,10E-01	1,59E-02	-0.018	-0.0174	-0.0168	2001	1000
θ_{85}	-0.02873	3.19E-4	1,65E-02	-0.02937	-0.02873	-0.02811	2001	1000
θ_{86}	0.03141	0.001577	8,17E-02	0.02838	0.03137	0.03446	2001	1000
θ_{87}	0.109	0.0019	9,84E-02	0.1055	0.109	0.1128	2001	1000
θ_{88}	-0.1194	0.00604	3,13E-01	-0.1309	-0.1192	-0.1077	2001	1000
θ_{89}	0.04257	0.004624	2,39E-01	0.03366	0.04248	0.05144	2001	1000
θ_{90}	0.004705	0.001316	6,80E-02	0.002201	0.004737	0.00728	2001	1000
θ_{91}	-0.01687	4,62E-01	2,40E-02	-0.01776	-0.01686	-0.016	2001	1000
θ_{92}	-0.0127	1,44E-01	7,33E-03	-0.01298	-0.0127	-0.01242	2001	1000
θ_{93}	-0.0105	5,16E-02	2,46E-03	-0.0106	-0.0105	-0.0104	2001	1000
θ_{94}	0.02138	8,21E-01	4,25E-02	0.01981	0.02136	0.02296	2001	1000
θ_{95}	-0.0273	0.001318	6,83E-02	-0.02982	-0.02727	-0.02476	2001	1000
θ_{96}	0.0936	0.003222	1,67E-01	0.08747	0.09354	0.09981	2001	1000
θ_{97}	0.02706	0.001956	1,01E-01	0.02334	0.02708	0.03093	2001	1000
θ_{98}	-0.1143	0.003515	1,82E-01	-0.1211	-0.1143	-0.1077	2001	1000
θ_{99}	0.07304	0.005097	2.64E-4	0.06326	0.07294	0.08287	2001	1000
θ_{100}	-0.06001	0.003809	1,97E-01	-0.0673	-0.05993	-0.05268	2001	1000
θ_{101}	0.02083	0.002366	1,23E-01	0.01627	0.02078	0.02537	2001	1000
θ_{102}	0.03678	2,50E-01	1,27E-02	0.0363	0.03678	0.03727	2001	1000
θ_{103}	-0.01475	0.001349	6,99E-02	-0.01733	-0.01473	-0.01214	2001	1000
θ_{104}	0.06093	0.002055	1,07E-01	0.05703	0.06089	0.0649	2001	1000
θ_{105}	0.002807	0.001652	8,55E-02	-3,41E-01	0.002838	0.006033	2001	1000
θ_{106}	-0.008776	1,80E-01	9,30E-03	-0.009129	-0.008773	-0.008439	2001	1000
θ_{107}	-0.09667	0.002262	1,17E-01	-0.1011	-0.09662	-0.09243	2001	1000
θ_{108}	0.02613	0.003338	1,73E-01	0.01969	0.02607	0.03253	2001	1000
θ_{109}	0.02082	3,84E-01	1,97E-02	0.02008	0.02082	0.02159	2001	1000
θ_{110}	0.04061	5,43E-01	2,81E-02	0.03959	0.04061	0.04171	2001	1000
θ_{111}	-0.02734	0.001795	9,30E-02	-0.03078	-0.0273	-0.02388	2001	1000
θ_{112}	-0.005816	6,87E-01	3,55E-02	-0.007166	-0.005819	-0.004505	2001	1000
θ_{113}	0.03355	9,68E-01	5,02E-02	0.03173	0.03353	0.03544	2001	1000
θ_{114}	-0.04689	0.00215	1,11E-01	-0.05101	-0.04685	-0.04276	2001	1000
θ_{115}	-0.03166	5,56E-01	2,85E-02	-0.03272	-0.03165	-0.03058	2001	1000
θ_{116}	0.02694	0.001474	7,64E-02	0.02411	0.02691	0.02979	2001	1000
θ_{117}	-0.06269	0.002424	1,26E-01	-0.06734	-0.06264	-0.05805	2001	1000
θ_{118}	0.1085	0.004602	2,38E-01	0.09969	0.1084	0.1174	2001	1000
θ_{119}	0.03919	0.00213	1.1E-4	0.03515	0.03921	0.0434	2001	1000
θ_{120}	-0.06251	0.002474	1,28E-01	-0.06725	-0.06246	-0.05777	2001	1000
θ_{121}	0.09896	0.004354	2,26E-01	0.0906	0.09887	0.1074	2001	1000
θ_{122}	-0.06057	0.004439	2,30E-01	-0.06905	-0.06048	-0.052	2001	1000
θ_{123}	0.06962	0.003687	1.91E-4	0.06255	0.06954	0.07676	2001	1000
θ_{124}	-0.08321	0.004218	2,19E-01	-0.09129	-0.08312	-0.0751	2001	1000
θ_{125}	0.03765	0.00343	1,78E-01	0.03106	0.0376	0.04425	2001	1000
θ_{126}	-0.01298	0.001558	8,07E-02	-0.01595	-0.01294	-0.009972	2001	1000
θ_{127}	-0.02733	2.62E-4	1,35E-02	-0.02785	-0.02732	-0.02682	2001	1000
θ_{128}	0.0251	0.001374	7,12E-02	0.02247	0.02508	0.02776	2001	1000
θ_{129}	-0.007528	9,43E-01	4,88E-02	-0.009329	-0.007507	-0.005707	2001	1000
θ_{130}	-0.03876	7,41E-01	3,84E-02	-0.04023	-0.03875	-0.03737	2001	1000
θ_{131}	0.02746	0.001765	9,14E-02	0.02407	0.02742	0.03086	2001	1000
θ_{132}	-0.01546	0.001237	6,41E-02	-0.01783	-0.01544	-0.01307	2001	1000
θ_{133}	-0.004859	3,65E-01	1,88E-02	-0.005574	-0.004861	-0.004164	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{134}	0.009533	3,46E-01	1,79E-02	0.008874	0.009525	0.0102	2001	1000
θ_{135}	0.05239	0.001085	5,62E-02	0.05037	0.05238	0.05454	2001	1000
θ_{136}	-0.0391	0.002443	1,27E-01	-0.04378	-0.03905	-0.0344	2001	1000
θ_{137}	-0.01815	7,21E-01	3,72E-02	-0.01957	-0.01815	-0.01678	2001	1000
θ_{138}	-0.1238	0.002789	1,45E-01	-0.1293	-0.1238	-0.1186	2001	1000
θ_{139}	0.04539	0.004575	2,37E-01	0.03658	0.0453	0.05417	2001	1000
θ_{140}	0.02764	7,95E-01	4,09E-02	0.02612	0.02764	0.02922	2001	1000
θ_{141}	-0.101	0.003269	1,69E-01	-0.1073	-0.1009	-0.09479	2001	1000
θ_{142}	0.09713	0.005358	2,78E-01	0.08685	0.09701	0.1075	2001	1000
θ_{143}	-0.02758	0.003612	1.87E-4	-0.03448	-0.0275	-0.0206	2001	1000
θ_{144}	-0.02911	2,32E-01	1,16E-02	-0.02958	-0.02911	-0.02867	2001	1000
θ_{145}	6,02E-02	7,38E-01	3,82E-02	-0.001369	4,78E-02	0.001471	2001	1000
θ_{146}	-0.01389	4,15E-01	2,15E-02	-0.01469	-0.01388	-0.01311	2001	1000
θ_{147}	0.01699	8,28E-01	4,29E-02	0.0154	0.01697	0.01859	2001	1000
θ_{148}	-0.0289	0.001247	6,46E-02	-0.03129	-0.02888	-0.02651	2001	1000
θ_{149}	-0.008362	6,22E-01	3,22E-02	-0.009582	-0.008367	-0.007175	2001	1000
θ_{150}	0.07855	0.002203	1,14E-01	0.07439	0.07849	0.08284	2001	1000
θ_{151}	-0.0192	0.002686	1.39E-4	-0.02432	-0.01913	-0.014	2001	1000
θ_{152}	0.007858	8,95E-01	4,63E-02	0.006133	0.00784	0.009574	2001	1000
θ_{153}	0.007417	7,83E-02	3,97E-03	0.007266	0.007418	0.007571	2001	1000
θ_{154}	-0.08344	0.002345	1,22E-01	-0.08795	-0.08338	-0.07901	2001	1000
θ_{155}	0.08353	0.004485	2,32E-01	0.07493	0.08344	0.09221	2001	1000
θ_{156}	-0.09681	0.004987	2,58E-01	-0.1064	-0.0967	-0.08722	2001	1000
θ_{157}	0.08049	0.004945	2,56E-01	0.071	0.08039	0.09004	2001	1000
θ_{158}	0.06623	7,44E-01	3,77E-02	0.06479	0.06624	0.06768	2001	1000
θ_{159}	-0.01025	0.001923	9,96E-02	-0.01392	-0.0102	-0.006518	2001	1000
θ_{160}	-0.06777	0.001351	7,00E-02	-0.07043	-0.06775	-0.06523	2001	1000
θ_{161}	0.01759	0.002304	1,19E-01	0.01315	0.01755	0.02201	2001	1000
θ_{162}	0.03479	2,84E-01	1,46E-02	0.03425	0.03479	0.03536	2001	1000
θ_{163}	0.007981	7,14E-01	3,69E-02	0.006622	0.007991	0.009388	2001	1000
θ_{164}	0.02955	6,11E-01	3,17E-02	0.02841	0.02954	0.03076	2001	1000
θ_{165}	0.03472	1,12E-01	5,13E-03	0.0345	0.03472	0.03495	2001	1000
θ_{166}	0.02038	3,80E-01	1.95E-5	0.01965	0.02038	0.02114	2001	1000
θ_{167}	-0.05289	0.001867	9,67E-02	-0.05648	-0.05285	-0.04933	2001	1000
θ_{168}	0.03398	0.002381	1,23E-01	0.02941	0.03393	0.03857	2001	1000
θ_{169}	-0.04239	0.002147	1,11E-01	-0.0465	-0.04235	-0.03827	2001	1000
θ_{170}	0.1285	0.004574	2.37E-4	0.1197	0.1284	0.1373	2001	1000
θ_{171}	-0.07184	0.005509	2,85E-01	-0.08237	-0.07173	-0.06119	2001	1000
θ_{172}	-0.08294	2,05E-01	7,51E-03	-0.08336	-0.08293	-0.08254	2001	1000
θ_{173}	0.07911	0.004179	2,17E-01	0.07109	0.07902	0.0872	2001	1000
θ_{174}	-0.003258	0.002433	1,26E-01	-0.007896	-0.003215	0.001476	2001	1000
θ_{175}	0.02312	8.59E-4	4,45E-02	0.02148	0.0231	0.02477	2001	1000
θ_{176}	0.07204	0.001207	6.25E-5	0.06977	0.07202	0.07444	2001	1000
θ_{177}	-0.06855	0.003721	1,93E-01	-0.07568	-0.06847	-0.0614	2001	1000
θ_{178}	0.03341	0.002906	1,51E-01	0.02783	0.03337	0.039	2001	1000
θ_{179}	0.02202	5,09E-01	2,62E-02	0.02105	0.02202	0.02302	2001	1000
θ_{180}	-0.04819	0.001778	9,21E-02	-0.0516	-0.04815	-0.04479	2001	1000
θ_{181}	-0.04457	2,42E-01	1,17E-02	-0.04504	-0.04457	-0.04412	2001	1000
θ_{182}	0.03881	0.002139	1,11E-01	0.03471	0.03877	0.04295	2001	1000
θ_{183}	0.004709	0.001037	5,37E-02	0.002734	0.004732	0.006742	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{184}	-0.03293	8,98E-01	4,66E-02	-0.03466	-0.03291	-0.03124	2001	1000
θ_{185}	0.0348	0.001816	9,41E-02	0.03132	0.03476	0.03831	2001	1000
θ_{186}	-0.09509	0.00349	1,81E-01	-0.1018	-0.09501	-0.08841	2001	1000
θ_{187}	0.1047	0.005416	2,81E-01	0.09427	0.1046	0.1151	2001	1000
θ_{188}	-0.004193	0.003208	1.66E-4	-0.01031	-0.004137	0.002047	2001	1000
θ_{189}	-0.09484	0.002114	1,10E-01	-0.09896	-0.0948	-0.09088	2001	1000
θ_{190}	0.122	0.005758	2,98E-01	0.111	0.1219	0.1332	2001	1000
θ_{191}	-0.00104	0.0036	1,86E-01	-0.007901	-9,69E-01	0.005973	2001	1000
θ_{192}	-0.04364	8,42E-01	4,36E-02	-0.04531	-0.04363	-0.04206	2001	1000
θ_{193}	0.03248	0.002028	1.05E-4	0.02859	0.03244	0.0364	2001	1000
θ_{194}	0.06313	6,54E-01	3.37E-5	0.06189	0.06313	0.06445	2001	1000
θ_{195}	-0.03208	0.002507	1,30E-01	-0.03687	-0.03203	-0.02723	2001	1000

Table A.3 (Charleston, USA)

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
α_0	2.956	0.03325	0.001155	2.89	2.956	3.018	2001	1000
α_1	0.9898	0.01131	0.7633	0.9675	0.99	1.01	2001	1000
α_2	0.01024	0.01132	0.7611	-0.01021	0.01006	0.03251	2001	1000
τ	921.1	58.2	1.643	778.3	931.9	997.2	2001	1000
θ_3	0.02459	0.03352	0.002255	-0.03597	0.02407	0.09059	2001	1000
θ_4	0.04939	0.6296	4.25E-5	0.04815	0.0494	0.05054	2001	1000
θ_5	-0.03609	0.9828	0.06624	-0.03786	-0.0361	-0.03415	2001	1000
θ_6	-0.02102	1.84E-4	0.01224	-0.02138	-0.02102	-0.02068	2001	1000
θ_7	0.02349	0.5064	0.03415	0.0225	0.0235	0.02444	2001	1000
θ_8	-0.01051	0.3936	0.02651	-0.01121	-0.01051	-0.00973	2001	1000
θ_9	0.001432	0.1405	0.009456	0.001156	0.001434	0.001698	2001	1000
θ_{10}	0.008714	0.08179	0.005522	0.008552	0.008715	0.008863	2001	1000
θ_{11}	-0.02258	0.3583	0.02417	-0.02323	-0.02259	-0.02187	2001	1000
θ_{12}	-0.005985	0.1937	1.3E-5	-0.00636	-0.00598	-0.005616	2001	1000
θ_{13}	-0.04896	4.93E-4	0.03329	-0.04985	-0.04896	-0.04797	2001	1000
θ_{14}	0.03626	0.9783	0.06594	0.03434	0.03628	0.03811	2001	1000
θ_{15}	-0.03638	0.8397	0.05661	-0.0379	-0.0364	-0.03472	2001	1000
θ_{16}	0.02249	0.6811	4.59E-5	0.02115	0.0225	0.02378	2001	1000
θ_{17}	0.005069	0.2064	0.01386	0.004694	0.005065	0.005472	2001	1000
θ_{18}	-0.002095	7.97E-5	0.005369	-0.002238	-0.002096	-0.001938	2001	1000
θ_{19}	0.009593	0.1343	0.009063	0.009329	0.009596	0.009838	2001	1000
θ_{20}	0.01853	0.1013	0.006829	0.01833	0.01853	0.01872	2001	1000
θ_{21}	0.003316	0.1751	0.01176	0.002999	0.003314	0.003659	2001	1000
θ_{22}	0.00522	0.02377	1.6E-6	0.005172	0.005221	0.005264	2001	1000
θ_{23}	0.003669	0.01837	0.001206	0.003634	0.003669	0.003705	2001	1000
θ_{24}	-0.002027	0.06487	0.004371	-0.002143	-0.002028	-0.001899	2001	1000
θ_{25}	-0.01459	0.1429	0.009651	-0.01485	-0.01459	-0.01431	2001	1000
θ_{26}	-0.04685	0.3675	0.02481	-0.04752	-0.04685	-0.04611	2001	1000
θ_{27}	0.00609	0.6087	0.04097	0.004896	0.006101	0.007244	2001	1000
θ_{28}	0.04698	4.61E-4	0.03113	0.04607	0.04699	0.04782	2001	1000
θ_{29}	-0.5568	0.5482	0.03688	-0.001547	-0.5652	0.5231	2001	1000
θ_{30}	0.03833	0.4499	0.03037	0.03744	0.03834	0.03915	2001	1000
θ_{31}	-0.03847	0.8817	0.05944	-0.04006	-0.03848	-0.03672	2001	1000
θ_{32}	0.01255	0.5919	0.03987	0.01139	0.01256	0.01367	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{33}	-0.01334	0.3018	0.02035	-0.01389	-0.01334	-0.01274	2001	1000
θ_{34}	0.02764	0.4711	0.03178	0.02672	0.02765	0.02852	2001	1000
θ_{35}	-0.004799	0.3756	0.02528	-0.005476	-0.004805	-0.004057	2001	1000
θ_{36}	-0.009275	0.04755	0.003205	-0.009362	-0.009276	-0.009178	2001	1000
θ_{37}	-0.005256	0.04683	0.003116	-0.005347	-0.005255	-0.005169	2001	1000
θ_{38}	-0.02309	0.2043	1.38E-5	-0.02346	-0.02309	-0.02267	2001	1000
θ_{39}	0.0453	0.7831	0.05282	0.04377	0.04532	0.04676	2001	1000
θ_{40}	-0.02619	0.8246	0.05557	-0.02767	-0.0262	-0.02456	2001	1000
θ_{41}	-0.025	0.03103	0.001566	-0.02506	-0.025	-0.02494	2001	1000
θ_{42}	-0.0322	0.08555	0.005662	-0.03236	-0.0322	-0.03202	2001	1000
θ_{43}	-0.006955	0.2897	0.01946	-0.007518	-0.00695	-0.006404	2001	1000
θ_{44}	0.03155	0.4367	0.02947	0.03069	0.03156	0.03234	2001	1000
θ_{45}	-0.02797	0.6842	0.04613	-0.0292	-0.02798	-0.02662	2001	1000
θ_{46}	0.02424	0.6034	0.04067	0.02306	0.02425	0.02538	2001	1000
θ_{47}	0.01575	0.1048	0.006934	0.01555	0.01575	0.01595	2001	1000
θ_{48}	0.01385	0.02411	0.001406	0.0138	0.01385	0.0139	2001	1000
θ_{49}	-0.003525	0.1983	0.01335	-0.003882	-0.003528	-0.003133	2001	1000
θ_{50}	0.02637	0.3435	0.02318	0.0257	0.02638	0.027	2001	1000
θ_{51}	-0.01518	0.4781	0.03222	-0.01604	-0.01519	-0.01423	2001	1000
θ_{52}	0.007595	0.2651	0.01786	0.007073	0.0076	0.008097	2001	1000
θ_{53}	-0.01236	0.2306	0.01555	-0.01278	-0.01236	-0.0119	2001	1000
θ_{54}	0.004035	0.1897	0.01277	0.003661	0.004038	0.004394	2001	1000
θ_{55}	-0.05385	0.6631	0.04476	-0.05505	-0.05386	-0.05252	2001	1000
θ_{56}	-0.02106	0.3829	0.02564	-0.0218	-0.02105	-0.02033	2001	1000
θ_{57}	0.04091	0.7037	0.04747	0.03953	0.04093	0.04222	2001	1000
θ_{58}	0.003642	0.4335	0.02914	0.002858	0.003636	0.004494	2001	1000
θ_{59}	-0.00749	0.1227	0.008274	-0.007713	-0.007492	-0.007246	2001	1000
θ_{60}	0.0611	0.7847	0.05296	0.05956	0.06112	0.06254	2001	1000
θ_{61}	-0.05089	0.001287	0.08676	-0.05321	-0.05091	-0.04834	2001	1000
θ_{62}	-0.02761	0.2814	0.01876	-0.02816	-0.0276	-0.02709	2001	1000
θ_{63}	0.02946	0.6489	0.04375	0.0282	0.02947	0.03068	2001	1000
θ_{64}	0.007209	0.2615	0.01755	0.006734	0.007204	0.007719	2001	1000
θ_{65}	-0.04872	0.6361	0.04293	-0.04988	-0.04873	-0.04746	2001	1000
θ_{66}	0.05567	0.001199	0.08083	0.05333	0.05569	0.05793	2001	1000
θ_{67}	0.01569	0.4702	0.03155	0.01484	0.01568	0.01661	2001	1000
θ_{68}	-0.008675	0.2735	0.01843	-0.009166	-0.008679	-0.008135	2001	1000
θ_{69}	-0.004799	0.04749	0.003164	-0.004891	-0.004798	-0.004711	2001	1000
θ_{70}	0.004137	0.1016	0.006846	0.003938	0.004138	0.004328	2001	1000
θ_{71}	-0.07588	0.9151	0.06177	-0.07753	-0.0759	-0.07406	2001	1000
θ_{72}	0.04439	0.001383	0.09321	0.04167	0.04442	0.047	2001	1000
θ_{73}	-0.01856	0.7334	0.04941	-0.01988	-0.01857	-0.01712	2001	1000
θ_{74}	-0.01402	0.06121	0.003996	-0.01414	-0.01402	-0.0139	2001	1000
θ_{75}	0.02677	0.4651	0.03137	0.02586	0.02678	0.02763	2001	1000
θ_{76}	0.01373	0.1548	0.01033	0.01345	0.01373	0.01403	2001	1000
θ_{77}	0.0113	0.02825	0.001764	0.01125	0.0113	0.01135	2001	1000
θ_{78}	0.01063	1.18E-5	0.0005461	0.0106	0.01063	0.01065	2001	1000
θ_{79}	-0.01836	3.31E-4	0.02233	-0.01896	-0.01837	-0.01771	2001	1000
θ_{80}	-0.02719	0.09909	0.006642	-0.02738	-0.0272	-0.02699	2001	1000
θ_{81}	0.06024	0.9995	0.06743	0.05828	0.06026	0.06209	2001	1000
θ_{82}	-0.04901	0.001258	8.48E-5	-0.05127	-0.04903	-0.04652	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{83}	0.02514	8.6E-4	0.05794	0.02345	0.02516	0.02677	2001	1000
θ_{84}	-0.04287	0.7856	0.05298	-0.04429	-0.04289	-0.04131	2001	1000
θ_{85}	0.02941	0.8337	0.05619	0.02777	0.02943	0.03099	2001	1000
θ_{86}	0.009358	0.2384	0.01598	0.008925	0.009354	0.009821	2001	1000
θ_{87}	-0.05157	0.6934	4.68E-5	-0.05283	-0.05158	-0.05019	2001	1000
θ_{88}	0.04047	0.001058	0.07134	0.0384	0.04049	0.04247	2001	1000
θ_{89}	0.03929	0.04182	0.001855	0.0392	0.03929	0.03937	2001	1000
θ_{90}	-0.06726	0.001217	0.08205	-0.06947	-0.06729	-0.06485	2001	1000
θ_{91}	0.08483	0.001749	1.18E-4	0.08141	0.08486	0.08811	2001	1000
θ_{92}	-0.01646	0.001175	0.07914	-0.01858	-0.01648	-0.01414	2001	1000
θ_{93}	-0.02731	0.1131	0.007605	-0.02752	-0.02732	-0.02708	2001	1000
θ_{94}	-0.02601	2.76E-5	0.001221	-0.02606	-0.02601	-0.02595	2001	1000
θ_{95}	0.04432	8.03E-4	0.05416	0.04275	0.04434	0.04582	2001	1000
θ_{96}	-0.0269	0.8218	0.05538	-0.02838	-0.02692	-0.02528	2001	1000
θ_{97}	0.04253	0.8014	0.05405	0.04096	0.04255	0.04403	2001	1000
θ_{98}	-0.04397	0.9962	0.06717	-0.04577	-0.04399	-0.042	2001	1000
θ_{99}	0.01123	6.41E-4	0.04316	0.009969	0.01124	0.01244	2001	1000
θ_{100}	-0.01317	0.2853	0.01924	-0.01369	-0.01318	-0.01261	2001	1000
θ_{101}	0.03199	0.5187	0.03499	0.03097	0.032	0.03295	2001	1000
θ_{102}	0.02994	0.03895	0.002023	0.02986	0.02994	0.03002	2001	1000
θ_{103}	0.3062	0.3385	0.02277	-0.3054	0.3009	0.9726	2001	1000
θ_{104}	-0.05162	0.5897	0.03981	-0.05268	-0.05163	-0.05044	2001	1000
θ_{105}	0.00264	0.6263	0.04214	0.001413	0.002652	0.003828	2001	1000
θ_{106}	-0.003141	7.25E-5	0.004888	-0.003272	-0.003142	-0.002998	2001	1000
θ_{107}	-0.002155	0.01225	0.0008071	-0.002178	-0.002155	-0.002131	2001	1000
θ_{108}	0.03134	0.3824	0.02581	0.03058	0.03134	0.03203	2001	1000
θ_{109}	0.005456	0.3001	0.02016	0.004912	0.005451	0.006043	2001	1000
θ_{110}	-0.08375	0.001016	0.06857	-0.08558	-0.08377	-0.08172	2001	1000
θ_{111}	0.04857	0.001522	0.1025	0.04557	0.04859	0.05144	2001	1000
θ_{112}	0.002628	5.41E-4	0.03638	0.00165	0.00262	0.003692	2001	1000
θ_{113}	-0.02136	0.2684	0.01811	-0.02184	-0.02136	-0.02082	2001	1000
θ_{114}	0.01798	4.52E-4	0.03047	0.0171	0.01799	0.01883	2001	1000
θ_{115}	0.02688	0.09858	0.006609	0.02668	0.02688	0.02706	2001	1000
θ_{116}	0.005939	0.2406	0.01616	0.005503	0.005936	0.00641	2001	1000
θ_{117}	-0.04618	0.5928	0.04001	-0.04726	-0.04619	-0.045	2001	1000
θ_{118}	0.02501	0.8193	0.05521	0.0234	0.02503	0.02656	2001	1000
θ_{119}	0.03781	1.4E-4	0.009389	0.03753	0.03782	0.03807	2001	1000
θ_{120}	-0.03979	0.8876	0.05985	-0.04139	-0.0398	-0.03803	2001	1000
θ_{121}	-0.02813	0.1454	0.009553	-0.02842	-0.02813	-0.02786	2001	1000
θ_{122}	0.0158	0.5003	0.03371	0.01482	0.01581	0.01675	2001	1000
θ_{123}	0.006528	0.1115	0.007467	0.006325	0.006527	0.006744	2001	1000
θ_{124}	-0.005233	0.1332	0.008977	-0.005473	-0.005235	-0.00497	2001	1000
θ_{125}	-0.02426	0.2161	0.01459	-0.02465	-0.02426	-0.02382	2001	1000
θ_{126}	0.007343	0.3632	0.02446	0.006628	0.007349	0.00803	2001	1000
θ_{127}	-0.4619	0.09296	0.006255	-0.6297	-0.4635	-0.2786	2001	1000
θ_{128}	-0.06133	0.6944	0.04688	-0.06259	-0.06134	-0.05994	2001	1000
θ_{129}	0.04434	0.001214	0.08183	0.04196	0.04436	0.04663	2001	1000
θ_{130}	-0.02064	0.7548	0.05085	-0.022	-0.02065	-0.01915	2001	1000
θ_{131}	0.02418	0.5197	0.03504	0.02317	0.02419	0.02516	2001	1000
θ_{132}	-0.01076	0.4046	0.02725	-0.01149	-0.01077	-0.009967	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{133}	0.003204	0.1638	0.01103	0.002882	0.003207	0.003514	2001	1000
θ_{134}	0.02565	0.2548	1.72E-5	0.02514	0.02565	0.02611	2001	1000
θ_{135}	-0.01164	0.4286	0.02887	-0.01241	-0.01165	-0.0108	2001	1000
θ_{136}	-0.0356	0.2697	0.01821	-0.03609	-0.0356	-0.03505	2001	1000
θ_{137}	0.02416	0.6852	0.04618	0.02281	0.02417	0.02545	2001	1000
θ_{138}	-0.02766	0.5989	0.04038	-0.02874	-0.02767	-0.02648	2001	1000
θ_{139}	-0.01512	0.1507	0.01004	-0.01542	-0.01512	-0.01484	2001	1000
θ_{140}	0.05789	0.8323	0.05616	0.05625	0.05791	0.05942	2001	1000
θ_{141}	0.02787	0.3537	0.02363	0.02722	0.02786	0.02855	2001	1000
θ_{142}	-0.01032	0.4326	0.02914	-0.0111	-0.01033	-0.009467	2001	1000
θ_{143}	0.0168	0.3142	0.02119	0.01619	0.01681	0.01739	2001	1000
θ_{144}	-0.006133	0.2652	0.01787	-0.00661	-0.006138	-0.005609	2001	1000
θ_{145}	0.01874	0.2868	0.01935	0.01818	0.01874	0.01927	2001	1000
θ_{146}	-0.07727	0.001099	0.07419	-0.07927	-0.07729	-0.07508	2001	1000
θ_{147}	0.04565	0.001415	0.09537	0.04287	0.04568	0.04833	2001	1000
θ_{148}	-0.0108	0.6596	0.04441	-0.01198	-0.0108	-0.00949	2001	1000
θ_{149}	-0.00825	0.03688	2.41E-6	-0.008322	-0.00825	-0.008179	2001	1000
θ_{150}	-0.00281	0.06197	0.004153	-0.00293	-0.002809	-0.002692	2001	1000
θ_{151}	-0.009353	0.07548	0.005096	-0.009491	-0.009354	-0.009201	2001	1000
θ_{152}	0.04304	0.5991	0.04043	0.04186	0.04305	0.04413	2001	1000
θ_{153}	-0.03009	0.8415	0.05671	-0.03161	-0.03011	-0.02843	2001	1000
θ_{154}	0.02652	0.6553	0.04418	0.02524	0.02654	0.02776	2001	1000
θ_{155}	0.01812	0.1046	0.006899	0.01792	0.01812	0.01833	2001	1000
θ_{156}	0.03644	0.2113	0.01425	0.03602	0.03645	0.03683	2001	1000
θ_{157}	-0.05532	0.00105	0.07082	-0.05722	-0.05534	-0.05323	2001	1000
θ_{158}	-0.02583	0.3496	0.02337	-0.0265	-0.02582	-0.02517	2001	1000
θ_{159}	0.05786	9.52E-4	0.06423	0.05599	0.05788	0.05962	2001	1000
θ_{160}	0.06947	0.1335	8.57E-6	0.0692	0.06948	0.06972	2001	1000
θ_{161}	-0.04684	0.00133	0.08962	-0.04923	-0.04686	-0.04421	2001	1000
θ_{162}	-0.0457	0.04756	0.002058	-0.04579	-0.0457	-0.04561	2001	1000
θ_{163}	0.006865	0.6004	0.04041	0.005686	0.006875	0.008002	2001	1000
θ_{164}	0.01868	0.1291	0.008717	0.01843	0.01869	0.01892	2001	1000
θ_{165}	-0.01581	0.3953	0.02665	-0.01652	-0.01582	-0.01503	2001	1000
θ_{166}	-0.03945	0.2666	1.8E-5	-0.03993	-0.03945	-0.03891	2001	1000
θ_{167}	0.004994	0.5106	0.03437	0.003992	0.005003	0.005961	2001	1000
θ_{168}	0.07422	0.7856	0.05304	0.07266	0.07423	0.07564	2001	1000
θ_{169}	-0.04998	0.001427	0.09614	-0.05254	-0.05	-0.04716	2001	1000
θ_{170}	-0.03151	0.2286	0.01516	-0.03195	-0.03151	-0.03108	2001	1000
θ_{171}	0.03381	0.7437	0.05014	0.03236	0.03383	0.03522	2001	1000
θ_{172}	0.01544	0.2187	0.01462	0.01504	0.01544	0.01587	2001	1000
θ_{173}	-0.03132	0.5317	0.03587	-0.03228	-0.03133	-0.03026	2001	1000
θ_{174}	0.01239	0.5047	3.4E-5	0.01139	0.01239	0.01334	2001	1000
θ_{175}	-0.3949	0.1513	0.01018	-0.6681	-0.3974	-0.09673	2001	1000
θ_{176}	0.01877	0.2205	0.01488	0.01833	0.01877	0.01917	2001	1000
θ_{177}	0.01354	0.06364	0.004167	0.01341	0.01354	0.01366	2001	1000
θ_{178}	-0.0262	0.4532	0.03057	-0.02703	-0.02621	-0.0253	2001	1000
θ_{179}	-0.004995	0.2474	0.01662	-0.005476	-0.004991	-0.004525	2001	1000
θ_{180}	-0.01009	0.06103	0.004118	-0.0102	-0.01009	-0.009969	2001	1000
θ_{181}	0.05165	0.7058	0.04763	0.05026	0.05166	0.05294	2001	1000
θ_{182}	0.03081	0.5974	0.04018	-0.001048	0.02164	0.001207	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{183}	-0.01936	0.2154	0.01454	-0.01975	-0.01937	-0.01893	2001	1000
θ_{184}	0.005954	0.2915	0.01963	0.005381	0.005959	0.006506	2001	1000
θ_{185}	0.02729	2.41E-4	0.01627	0.02681	0.0273	0.02773	2001	1000
θ_{186}	0.01607	0.1321	0.008777	0.01583	0.01607	0.01633	2001	1000
θ_{187}	-0.004744	0.2365	0.01592	-0.00517	-0.004748	-0.004276	2001	1000
θ_{188}	-0.00845	0.04021	0.002708	-0.008523	-0.008451	-0.008368	2001	1000
θ_{189}	0.00338	0.1355	0.009131	0.003113	0.003383	0.003637	2001	1000

Table A.4 (Ankara, Turkey)

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
α_0	2.519	0.07448	0.002579	2.369	2.521	2.671	2001	1000
α_1	0.9698	0.0277	7.83E-4	0.9161	0.9698	1.024	2001	1000
α_2	0.03084	0.02779	7,84E-01	-0.02304	0.03124	0.08398	2001	1000
τ	187.4	26.81	0.7386	139.8	186.7	246.2	2001	1000
θ_3	0.1182	0.06885	0.001943	-0.01538	0.1193	0.25	2001	1000
θ_4	-0.06937	0.003175	8.97E-5	-0.07555	-0.06936	-0.06317	2001	1000
θ_5	9,70E-01	0.002116	5,97E-02	-0.003064	9,50E-01	0.005069	2001	1000
θ_6	0.02702	6,77E-01	1,92E-02	0.02572	0.02702	0.02834	2001	1000
θ_7	-0.06205	0.002565	7,25E-02	-0.06703	-0.06205	-0.05701	2001	1000
θ_8	0.03398	0.002826	7,98E-02	0.02865	0.03397	0.03951	2001	1000
θ_9	-0.1084	0.004155	1,17E-01	-0.1165	-0.1084	-0.1002	2001	1000
θ_{10}	0.1454	0.007379	2,09E-01	0.1315	0.1454	0.1598	2001	1000
θ_{11}	0.00319	0.004309	1,22E-01	-0.005162	0.003246	0.01143	2001	1000
θ_{12}	-0.03303	8,98E-01	2,54E-02	-0.03476	-0.03303	-0.03128	2001	1000
θ_{13}	0.1091	0.004086	1,16E-01	0.1013	0.1091	0.117	2001	1000
θ_{14}	-0.1179	0.006613	1,87E-01	-0.1307	-0.1178	-0.1051	2001	1000
θ_{15}	0.01296	0.003956	1,12E-01	0.005448	0.01294	0.02064	2001	1000
θ_{16}	0.02872	3,30E-01	9,34E-03	0.02807	0.02871	0.02936	2001	1000
θ_{17}	-0.04573	0.002136	6,04E-02	-0.04988	-0.04572	-0.04156	2001	1000
θ_{18}	0.008183	0.001611	4,55E-02	0.005131	0.008175	0.01131	2001	1000
θ_{19}	-0.02733	0.001065	3.01E-5	-0.0294	-0.02733	-0.02523	2001	1000
θ_{20}	0.05286	0.002324	6,57E-02	0.04846	0.05286	0.0574	2001	1000
θ_{21}	-0.05948	0.003282	9,27E-02	-0.06586	-0.05946	-0.05312	2001	1000
θ_{22}	0.03074	0.002683	7,58E-02	0.02568	0.03072	0.03599	2001	1000
θ_{23}	0.07451	0.001172	3,32E-02	0.07222	0.07452	0.07682	2001	1000
θ_{24}	-0.1189	0.00556	1,57E-01	-0.1297	-0.1189	-0.108	2001	1000
θ_{25}	0.01619	0.004043	1,14E-01	0.008518	0.01617	0.02405	2001	1000
θ_{26}	0.07233	0.001478	4.18E-5	0.06949	0.07232	0.07526	2001	1000
θ_{27}	-0.04977	0.003536	9,99E-02	-0.05665	-0.04975	-0.04299	2001	1000
θ_{28}	0.03257	0.002465	6,96E-02	0.02793	0.03257	0.0374	2001	1000
θ_{29}	-0.1054	0.004019	1,14E-01	-0.1133	-0.1054	-0.09751	2001	1000
θ_{30}	0.1271	0.006769	1,91E-01	0.1144	0.1271	0.1404	2001	1000
θ_{31}	0.01628	0.003394	9,58E-02	0.009695	0.01634	0.02281	2001	1000
θ_{32}	-0.1661	0.0051	1,44E-01	-0.1759	-0.1661	-0.156	2001	1000
θ_{33}	0.1687	0.009725	2,75E-01	0.1504	0.1687	0.1878	2001	1000
θ_{34}	-0.06582	0.007014	1,98E-01	-0.07946	-0.06578	-0.05252	2001	1000
θ_{35}	-0.04758	7,70E-01	2,17E-02	-0.0491	-0.04759	-0.04604	2001	1000
θ_{36}	0.06457	0.003179	8,98E-02	0.05858	0.06457	0.0708	2001	1000
θ_{37}	-0.03647	0.002989	8,44E-02	-0.04229	-0.03645	-0.03076	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{38}	0.1094	0.004261	1,20E-01	0.1013	0.1094	0.1177	2001	1000
θ_{39}	-0.08526	0.005698	1,61E-01	-0.09635	-0.08522	-0.07431	2001	1000
θ_{40}	-0.03294	0.001691	4,77E-02	-0.03622	-0.03296	-0.02961	2001	1000
θ_{41}	0.00399	0.001004	2,83E-02	0.002085	0.003984	0.00594	2001	1000
θ_{42}	0.1185	0.003239	9,16E-02	0.1122	0.1185	0.1248	2001	1000
θ_{43}	-0.1532	0.007861	2,22E-01	-0.1685	-0.1531	-0.1379	2001	1000
θ_{44}	0.05315	0.00615	1,74E-01	0.04151	0.05312	0.06511	2001	1000
θ_{45}	-0.01032	0.002012	5,68E-02	-0.0142	-0.01031	-0.006501	2001	1000
θ_{46}	0.03567	0.001377	3,89E-02	0.03305	0.03567	0.03835	2001	1000
θ_{47}	-0.03654	0.002106	5.95E-5	-0.04064	-0.03653	-0.03247	2001	1000
θ_{48}	0.01903	0.001655	4,68E-02	0.01591	0.01902	0.02227	2001	1000
θ_{49}	-0.03608	0.001626	4,60E-02	-0.03924	-0.03608	-0.0329	2001	1000
θ_{50}	0.03154	0.001984	5,60E-02	0.02782	0.03154	0.03544	2001	1000
θ_{51}	-0.00947	0.001236	3.49E-5	-0.01187	-0.009463	-0.00713	2001	1000
θ_{52}	-0.02587	4,31E-01	1.22E-5	-0.02671	-0.02586	-0.02501	2001	1000
θ_{53}	0.02797	0.001551	4,38E-02	0.02506	0.02797	0.03101	2001	1000
θ_{54}	-0.002331	9,17E-01	2,59E-02	-0.004104	-0.00232	-5,87E-01	2001	1000
θ_{55}	0.04361	0.001341	3.79E-5	0.04102	0.04361	0.04621	2001	1000
θ_{56}	-0.05048	0.00273	7,71E-02	-0.05579	-0.05047	-0.04519	2001	1000
θ_{57}	0.09056	0.004114	1,16E-01	0.08278	0.09057	0.09861	2001	1000
θ_{58}	-0.09256	0.005362	1,51E-01	-0.103	-0.09252	-0.08219	2001	1000
θ_{59}	-0.05369	0.001307	3.68E-5	-0.05631	-0.05369	-0.05108	2001	1000
θ_{60}	0.03579	0.002516	7,11E-02	0.03106	0.03578	0.04073	2001	1000
θ_{61}	0.02589	3,78E-01	1,06E-02	0.02515	0.02589	0.02664	2001	1000
θ_{62}	0.009686	4,56E-01	1,29E-02	0.008788	0.009695	0.01058	2001	1000
θ_{63}	-0.05014	0.001694	4,79E-02	-0.05343	-0.05014	-0.04677	2001	1000
θ_{64}	0.01438	0.001899	5,36E-02	0.0108	0.01438	0.01808	2001	1000
θ_{65}	0.05724	0.001166	3,30E-02	0.05499	0.05723	0.05955	2001	1000
θ_{66}	-0.00928	0.00194	5,48E-02	-0.01302	-0.009268	-0.005595	2001	1000
θ_{67}	-0.04683	0.001012	2,86E-02	-0.0488	-0.04683	-0.04483	2001	1000
θ_{68}	-0.001478	0.001332	3,76E-02	-0.00402	-0.001497	0.001105	2001	1000
θ_{69}	0.02961	8,46E-01	2,39E-02	0.02797	0.02962	0.03126	2001	1000
θ_{70}	0.04141	3,25E-01	9,21E-03	0.04078	0.0414	0.04205	2001	1000
θ_{71}	-0.0263	0.001945	5,49E-02	-0.03008	-0.02629	-0.02257	2001	1000
θ_{72}	0.02749	0.001598	4,51E-02	0.02449	0.02749	0.03063	2001	1000
θ_{73}	-0.08172	0.003169	8,96E-02	-0.08788	-0.08172	-0.07547	2001	1000
θ_{74}	0.1203	0.00587	1,66E-01	0.1092	0.1203	0.1318	2001	1000
θ_{75}	-0.005823	0.003798	1,07E-01	-0.01317	-0.005785	0.001414	2001	1000
θ_{76}	-0.03946	8,42E-01	2.38E-5	-0.04109	-0.03946	-0.03779	2001	1000
θ_{77}	0.0849	0.003578	1,01E-01	0.07812	0.0849	0.09188	2001	1000
θ_{78}	-0.05485	0.004107	1.16E-4	-0.06283	-0.05482	-0.04698	2001	1000
θ_{79}	-0.01485	0.001281	3,61E-02	-0.01732	-0.01486	-0.01234	2001	1000
θ_{80}	-0.02857	4,35E-01	1,23E-02	-0.02942	-0.02857	-0.0277	2001	1000
θ_{81}	0.01407	0.001232	3.48E-5	0.01174	0.01406	0.01648	2001	1000
θ_{82}	0.006707	2,53E-01	7,12E-03	0.006207	0.006712	0.007207	2001	1000
θ_{83}	0.07561	0.001976	5,59E-02	0.07178	0.0756	0.07945	2001	1000
θ_{84}	-4,80E-01	0.002242	6,33E-02	-0.004822	-4,56E-01	0.003801	2001	1000
θ_{85}	-0.03456	9,03E-01	2,55E-02	-0.0363	-0.03456	-0.0328	2001	1000
θ_{86}	0.1089	0.004125	1,17E-01	0.101	0.1089	0.1169	2001	1000
θ_{87}	-0.1972	0.008872	2,51E-01	-0.2145	-0.1972	-0.1799	2001	1000

	mean	sd	MC.error	val2.5pc	median	val97.5pc	start	sample
θ_{88}	0.1381	0.009862	2,79E-01	0.1195	0.138	0.1574	2001	1000
θ_{89}	-0.02772	0.005057	1,43E-01	-0.03748	-0.0277	-0.01813	2001	1000
θ_{90}	0.00842	0.001195	3,37E-02	0.006163	0.008416	0.01074	2001	1000
θ_{91}	-0.1246	0.003835	1,08E-01	-0.132	-0.1246	-0.117	2001	1000
θ_{92}	0.1004	0.00655	1.85E-4	0.08812	0.1004	0.1133	2001	1000
θ_{93}	-3,80E-01	0.003096	8,74E-02	-0.006377	-3,47E-01	0.005531	2001	1000
θ_{94}	0.08229	0.002459	6,95E-02	0.07753	0.0823	0.08707	2001	1000
θ_{95}	-0.03842	0.003529	9,96E-02	-0.04528	-0.03839	-0.0317	2001	1000

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