**The Supplemental Materials for**

**“Dealing With Missing Data by EM in Single-Case Studies”**

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1. Purpose

This appendix aims to provide SAS 9.4 programs operated in Karst and all results obtained for “Dealing with Missing Data by EM in Single-Case Studies.” In addition to the purpose statement, the supplemental materials include six parts: (1) the SAS program for the study; (2) figures and ANOVA results of relative biases (RBs), root-mean-squared-errors (RMSEs), and relative bias of estimated standard error (RBESE) obtained from β1 = β2 = β3 = 0.1, paired with a short intervention phase; (3) figures and ANOVA results of RBs, RMSEs, and RBESE obtained from β1 = β2 = β3 = 0.1, paired with a long intervention phase; (4) figures and ANOVA results of RBs, RMSEs, and RBESE for other specifications of β1, β2, and β3; (5) mathematical proof of changes in the true values of βs resulting in the same bias in estimating β; and (6) all results for the simplified model using an alternative approach.

In Part 2: SAS Program, data from lag-1 time-series models were first generated, either the simplified model or the time-series model was then fitted to the data to create complete data conditions. Second, missing data were created under MAR, based on the binomial random variable (miss\_d). For the A phase data, the binomial random variable has the probability of a success of either 0, .1, or .2. For the B phase data, the binomial random variable has the probability of a success of either .1, .2, or .3. When the binomial random variable took on a value of 1, the corresponding data value became missing. Third, missing scores were imputed by EM. Fourth, either the simplified model or the time-series model were then fitted to the imputed data. Fifth, the performance of EM were evaluated via RB, RMSE, and RBESE.

In the manuscript, we deleted the data based on the manipulated missing data conditions and then replaced the missing *Y* scores using EM to fit either a simplified model or a time-series model. There is an alternative method for fitting the simplified model–using the final estimates of variances and covarainces obtained from EM. The last section of the supplemental materials present all results from this approach for the simplified model. In conclusion, the RBs and RMSEs estimated from the two approaches were very similar to each other under the same conditions. Moreover, under the same manipulated autocorrelations, phase length, and magnitude of βs, the RBESEs obtained from the alternative approach were more similar among the three manipulated missing rates compared to the RBESEs obtained from the original method used in the manuscript. In addition, the RBESEs obtained from the alternative approach for the three manipulated missing conditions were similar to the results obtained from the low missing rate (= 0% in A phase and 10% in B phase) of the approach used in the manuscript.

2. SAS program

I. SAS MACRO

a. SAS code for the results presented in the manuscript

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\* \*

\* Parameters for the MACRO include \*

\* dataseq = a variable created for combining results from ANOVA, \*

\* replication = number of replication, \* \* set = the index for autocorrelation conditions, used to match incomplete \* \* conditions with the corresponding complete conditions. \*

\* phil = the true value of lag-1 autocorrelation, \*

\* beta0 = the true value of beta0, \* \* beta1 = the true value of beta1, \*

\* beta2 = the true value of beta2, \*

\* beta3 = the true value of beta3, \*

\* missrate\_1 = manipulated missing rate for phase A, \* \* missrate\_2 = manipulated missing rate for phase B, \* \* Allow\_miss\_na = acceptable number of missing scores in phase A, \* \* Allow\_miss\_nb= acceptable number of missing scores in phase B, \*

\* na= the number of scores in phase A, \*

\* nb= the number of scores in phase B, \*

\* nb\_first =the session number of the first score in phase B, \*

\* nb\_last = the session number of the last score in phase B, and \*

\* seed = seed number. \*

\* \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*;

**%MACRO** SCDMissing(dataseq=, replication=, set=, phil=, beta0= , beta1= , beta2= , beta3= , missrate\_1=, missrate\_2=, Allow\_miss\_na=, Allow\_miss\_nb=, na=, nb=,nb\_first=, nb\_last=,seed=);

/\*If missing rate equals 0, complete data\*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* Generate data from lag-1 time-series model \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

%IF &missrate\_1=&missrate\_2 %THEN

%DO;

TITLE "&replication replication of missing rate(&missrate\_1+&missrate\_2)/2, with phil=&phil, na=&na, nb=&nb, beta0=&beta0, beta1=&beta1, beta2=&beta2, beta3=&beta3 ";

DATA na&na.\_nb&nb.\_r&replication.;

phil = &phil;

missrate\_1= &missrate\_1;

missrate\_2= &missrate\_2;

missrate = (missrate\_1 + missrate\_2)/**2**;

nAB= &nA + &nB;

beta0 =&beta0;

beta1=&beta1;

beta2=&beta2;

beta3=&beta3;

ARRAY score {\*} score1-score&nb\_last;

ARRAY error (\*) error1-error&nb\_last;

ARRAY noise {\*} noise1-noise&nb\_last;

ARRAY miss\_d (\*) miss\_d1-miss\_d&nb\_last;

ARRAY complete\_score {\*} complete\_score1-complete\_score&nb\_last;

INDEX=**0**;

N=**0**;

do UNTIL(INDEX=&replication);

DO j = **1** to nAB by **1**;

SET = INDEX;

T = j;

noise(j) = RANNOR(&seed);

IF j LE &nA THEN D =**0**;

IF j LE &nA THEN SC=**0**;

IF j GT &nA THEN D= **1**;

IF j GT &nA THEN SC= T - &nA -**1**;

IF j = **1** THEN error(j)=noise(j); /\*First noise = first error \*/

IF j GE **2** THEN error(j)=&phil\*error(j-**1**)+sqrt(**1**-phil\*\***2**)\*noise(j);

/\* Let the variance of the error at each session=1 \*/

score(j) = beta0 + beta1\*T + beta2\*D + beta3\*SC + error(j); /\* this is the data generating function for both phases\*/

END;

OUTPUT;

INDEX = INDEX + **1**;

END;

RUN;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* Use the method of least squares (simplified model) to estimate betas \*/ /\* for the complete data for each replication \*/ /\* \*/

/\* PROC IML applied \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

DATA complete\_scores;

SET na&na.\_nb&nb.\_r&replication. (KEEP = score1-score&nb\_last);

RUN;

PROC IML;

USE complete\_scores;

read all into A[colname=varNames];

beta0 = repeat(**1**,&na+&nb);

t = **1**:&na+&nb;

d = repeat( {**0**, **1**}, {&na &nb});

sc1 = repeat(**0**,&na);

sc2 = **0**:(&nb-**1**);

sc = sc1`||sc2;

y = A[,**1**:&na+&nb]`;

x = beta0||t`||d`||sc`;

yx = y || x;

varNames = "replication1":"replication&replication" || "beta0"|| "t"|| "d" ||"sc";

create data from yx [colname=varNames];

append from yx;

close data;

beta = j(&replication,**4**);

se = j(&replication,**4**);

DO i = **1** TO &replication; /\*Run the regression for ith column (i.e. each replication)\*/

b = inv(x`\*x) \* x`\*y[,i];

yhat = x \* b;

sigmahat = (y[,i]-yhat)`\*(y[,i]-yhat)/(&na+&nb-**4**);

var\_beta = sigmahat\*inv(x`\*x);

beta[i,**1**] = b[**1**];

beta[i,**2**] = b[**2**];

beta[i,**3**] = b[**3**];

beta[i,**4**] = b[**4**];

se[i,**1**] = sqrt(var\_beta[**1**,**1**]);

se[i,**2**] = sqrt(var\_beta[**2**,**2**]);

se[i,**3**] = sqrt(var\_beta[**3**,**3**]);

se[i,**4**] = sqrt(var\_beta[**4**,**4**]);

END;

varNames = "OLS\_beta0":"OLS\_beta3";

create OLS\_beta from beta [colname=varNames];

append from beta;

close OLS\_beta;

meanbeta = mean(beta);

varNames = "OLS\_meanbeta0":"OLS\_meanbeta3";

create OLS\_meanbeta from meanbeta [colname=varNames];;

append from meanbeta;

close OLS\_meanbeta;

varNames = "OLS\_se0":"OLS\_se3";

create OLS\_se from se [colname=varNames];

append from se;

close OLS\_se;

meanse = mean(se);

varNames = "OLS\_meanse0":"OLS\_meanse3";

create OLS\_meanse from meanse [colname=varNames];

append from meanse;

close OLS\_meanse;

RMSE0 = sqrt(sum((beta[,**1**]-&beta0)##**2**)/&replication);

RMSE1 = sqrt(sum((beta[,**2**]-&beta1)##**2**)/&replication);

RMSE2 = sqrt(sum((beta[,**3**]-&beta2)##**2**)/&replication);

RMSE3 = sqrt(sum((beta[,**4**]-&beta3)##**2**)/&replication);

RMSE = RMSE0||RMSE1||RMSE2||RMSE3;

varNames = "OLS\_RMSE\_beta0":"OLS\_RMSE\_beta3";

create OLS\_beta\_RMSE from RMSE [colname=varNames];;

append from RMSE;

close OLS\_beta\_RMSE;

quit;

DATA complete\_OLS\_meanse&set.;

SET OLS\_meanse(rename=(OLS\_meanse0=com\_OLS\_meanse0

OLS\_meanse1=com\_OLS\_meanse1

OLS\_meanse2=com\_OLS\_meanse2

OLS\_meanse3=com\_OLS\_meanse3));

RUN;

/\*Calculate the bias and relative bias of the Betas from OLS\*/

data OLS\_beta\_bias;

set OLS\_meanbeta;

OLS\_bias\_beta0=OLS\_meanbeta0-&beta0;

OLS\_bias\_beta1=OLS\_meanbeta1-&beta1;

OLS\_bias\_beta2=OLS\_meanbeta2-&beta2;

OLS\_bias\_beta3=OLS\_meanbeta3-&beta3;

OLS\_rbias\_beta1=OLS\_bias\_beta1/&beta1;

OLS\_rbias\_beta2=OLS\_bias\_beta2/&beta2;

OLS\_rbias\_beta3=OLS\_bias\_beta3/&beta3;

run;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* Use lag-1 time-series model to estimate betas for the \*/ /\* complete data for each replication \*/ /\* \*/

/\* PROC AUTOREG applied \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

PROC AUTOREG DATA=data OUTEST=parest COVOUT NOPRINT;

MODEL replication1 = t d sc / nlag=**1**;

RUN;

PROC IML;

USE parest;

read all into A[colname=varNames];

beta = A[**1**,**4**] || A[**1**, **6**:**8**];

varNames = "AR\_beta0":"AR\_beta3";

create AR\_beta from beta [colname=varNames];

append from beta;

close AR\_beta;

se = A[**2**:**5**, **3**]`;

varNames = "AR\_se0":"AR\_se3";

create AR\_se from se [colname=varNames];

append from se;

close AR\_se;

QUIT;

%DO r = **2** %TO &replication;

PROC AUTOREG DATA=data OUTEST=parest COVOUT NOPRINT;

MODEL replication&r = t d sc / nlag=**1**;

RUN;

PROC IML;

USE parest;

read all into A[colname=varNames];

beta = A[**1**,**4**] || A[**1**, **6**:**8**];

varNames = "AR\_beta0":"AR\_beta3";

create AR\_beta\_tmp from beta [colname=varNames];

append from beta;

close AR\_beta\_tmp;

se = A[**2**:**5**, **3**]`;

varNames = "AR\_se0":"AR\_se3";

create AR\_se\_tmp from se [colname=varNames];

append from se;

close AR\_se\_tmp;

QUIT;

DATA AR\_beta;

SET AR\_beta AR\_beta\_tmp;

RUN;

DATA AR\_se;

SET AR\_se AR\_se\_tmp;

RUN;

%END;

PROC MEANS DATA=AR\_beta noprint;

VAR AR\_beta0 AR\_beta1 AR\_beta2 AR\_beta3;

output out=AR\_meanbeta ;

RUN;

DATA AR\_meanbeta;

SET AR\_meanbeta;

IF \_STAT\_="MEAN";

RUN;

PROC MEANS DATA=AR\_se noprint;

VAR AR\_se0 AR\_se1 AR\_se2 AR\_se3;

output out=AR\_meanse ;

RUN;

DATA AR\_meanse(keep = AR\_se0 AR\_se1 AR\_se2 AR\_se3);

SET AR\_meanse;

IF \_STAT\_="MEAN";

RUN;

DATA complete\_AR\_meanse&set.;

SET AR\_meanse(rename=(AR\_se0=com\_AR\_se0

AR\_se1=com\_AR\_se1

AR\_se2=com\_AR\_se2

AR\_se3=com\_AR\_se3));

RUN;

/\*Calculate the bias and relative bias of the Betas for complete data Autoreg\*/

data AR\_beta\_bias;

set AR\_meanbeta;

AR\_bias\_beta0=AR\_beta0-&beta0;

AR\_bias\_beta1=AR\_beta1-&beta1;

AR\_bias\_beta2=AR\_beta2-&beta2;

AR\_bias\_beta3=AR\_beta3-&beta3;

AR\_rbias\_beta1=AR\_bias\_beta1/&beta1;

AR\_rbias\_beta2=AR\_bias\_beta2/&beta2;

AR\_rbias\_beta3=AR\_bias\_beta3/&beta3;

run;

/\*RMSE of beta estimates\*/

PROC IML;

USE AR\_beta;

read all into A[colname=varNames];

RMSE\_beta0 = sqrt(sum((A[,**1**]-&beta0)##**2**)/&replication);

RMSE\_beta1 = sqrt(sum((A[,**2**]-&beta1)##**2**)/&replication);

RMSE\_beta2 = sqrt(sum((A[,**3**]-&beta2)##**2**)/&replication);

RMSE\_beta3 = sqrt(sum((A[,**4**]-&beta3)##**2**)/&replication);

RMSE = RMSE\_beta0||RMSE\_beta1||RMSE\_beta2||RMSE\_beta3;

varNames = "AR\_RMSE\_beta0":"AR\_RMSE\_beta3";

create AR\_beta\_RMSE from RMSE [colname=varNames];

append from RMSE;

close AR\_beta\_RMSE;

DATA bias\_RMSE&dataseq.;

MERGE OLS\_beta\_bias (KEEP=OLS\_bias\_beta0 OLS\_bias\_beta1 OLS\_bias\_beta2 OLS\_bias\_beta3

OLS\_rbias\_beta1 OLS\_rbias\_beta2 OLS\_rbias\_beta3)

OLS\_beta\_RMSE

AR\_beta\_bias (KEEP=AR\_bias\_beta0 AR\_bias\_beta1 AR\_bias\_beta2 AR\_bias\_beta3

AR\_rbias\_beta1 AR\_rbias\_beta2 AR\_rbias\_beta3)

AR\_beta\_RMSE;

phil = &phil;

missrate\_1= &missrate\_1;

missrate\_2= &missrate\_2;

missrate = (missrate\_1 + missrate\_2)/**2**;

beta0=&beta0;

beta1=&beta1;

beta2=&beta2;

beta3=&beta3;

RUN;

%END;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* \*/

/\* Generate complete data using lag-1 time-series model and then create \*/ /\* missing data conditions under MAR \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

%ELSE

%DO;

TITLE "&replication replication of missing rate(&missrate\_1+&missrate\_2)/2, with phil=&phil, na=&na, nb=&nb, beta0=&beta0, beta1=&beta1, beta2=&beta2, beta3=&beta3 ";

DATA na&na.\_nb&nb.\_r&replication.;

phil = &phil;

missrate\_1= &missrate\_1;

missrate\_2= &missrate\_2;

missrate = (missrate\_1 + missrate\_2)/**2**;

nAB= &nA + &nB;

beta0 =&beta0;

beta1=&beta1;

beta2=&beta2;

beta3=&beta3;

ARRAY score {\*} score1-score&nb\_last;

ARRAY error (\*) error1-error&nb\_last;

ARRAY noise {\*} noise1-noise&nb\_last;

ARRAY miss\_d (\*) miss\_d1-miss\_d&nb\_last;

ARRAY complete\_score {\*} complete\_score1-complete\_score&nb\_last;

INDEX=**0**;

N=**0**;

do UNTIL(INDEX=&replication);

DO j = **1** to nAB by **1**;

SET = INDEX;

T = j;

noise(j) = RANNOR(&seed);

IF j LE &nA THEN D =**0**;

IF j LE &nA THEN SC=**0**;

IF j GT &nA THEN D= **1**;

IF j GT &nA THEN SC= T - &nA -**1**;

IF j = **1** THEN error(j)=noise(j); /\*First noise = first error \*/

IF j GE **2** THEN error(j)=&phil\*error(j-**1**)+sqrt(**1**-phil\*\***2**)\*noise(j);

/\* Let the variance of the error at each session=1 \*/

score(j) = beta0 + beta1\*T + beta2\*D + beta3\*SC + error(j);

complete\_score(j)=score(j);

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* Missing at random is created by manipulated the probability of missing \*/

/\* depending on the values of variables miss\_d \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\*assigned different binomial distribution to scores in phase A and scores in phase B\*/

IF D = **0** THEN miss\_d (j) =RANBIN(**0**,**1**,&missrate\_1); /\*The probability of missing for scores in phase A = missrate\_1\*/

IF D = **1** THEN miss\_d (j) =RANBIN(**0**,**1**,&missrate\_2); /\*The probability of missing for scores in phase B = missrate\_2\*/

IF miss\_d[j]=**1** THEN score[j]=**.**;

END;

NON\_MISS\_na=SUM(OF miss\_d1-miss\_d&na);

NON\_MISS\_nb=SUM(OF miss\_d&nb\_first-miss\_d&nb\_last);

IF &na-NON\_MISS\_na = &Allow\_miss\_na AND &nb\_last-&na-NON\_MISS\_nb = &Allow\_miss\_nb THEN OUTPUT;

IF &na-NON\_MISS\_na = &Allow\_miss\_na AND &nb\_last-&na-NON\_MISS\_nb = &Allow\_miss\_nb THEN INDEX = INDEX+**1**;

N=N+**1**;

/\* Only retain replications with acceptable number of missing scores in phase A and in phase B\*/

END;

run;

DATA incomplete\_scores;

SET na&na.\_nb&nb.\_r&replication. (KEEP = score1-score&nb\_last);

RUN;

PROC IML;

USE incomplete\_scores;

read all into A[colname=varNames];

beta0 = repeat(**1**,&na+&nb);

t = **1**:&na+&nb;

d = repeat( {**0**, **1**}, {&na &nb});

sc1 = repeat(**0**,&na);

sc2 = **0**:(&nb-**1**);

sc = sc1`||sc2;

y = A[,**1**:&na+&nb]`;

x = beta0||t`||d`||sc`;

yx = y || x;

varNames = "replication1":"replication&replication" || "beta0"|| "t"|| "d" ||"sc";

create na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi from yx [colname=varNames];

append from yx;

close na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* \*/

/\* Use EM to impute missing data \*/ /\* \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

PROC MI data=na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi NIMPUTE=**0** NOPRINT;

EM ITPRINT OUTEM=outem OUT=miem\_data MAXITER=**500**;

VAR replication1 t d sc;

RUN;

data miem\_data;

set miem\_data (keep=replication1);

%DO r = **2** %TO &replication;

PROC MI data=na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi NIMPUTE=**0** NOPRINT;

EM ITPRINT OUTEM=outem OUT=miem MAXITER=**500**;

VAR replication&r t d sc;

RUN;

DATA miem\_data;

merge miem\_data miem(keep=replication&r);

%END;

proc transpose data=miem\_data out=miem\_t

prefix=score;

run;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* \*/

/\* Use the method of least squares (simplified model) to estimate betas \*/

/\* for imputed data for each replication \*/ /\* \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

DATA scores;

SET miem\_t (KEEP = score1-score&nb\_last);

RUN;

PROC IML;

USE scores;

read all into A[colname=varNames];

beta0 = repeat(**1**,&na+&nb);

t = **1**:&na+&nb;

d = repeat( {**0**, **1**}, {&na &nb});

sc1 = repeat(**0**,&na);

sc2 = **0**:(&nb-**1**);

sc = sc1`||sc2;

y = A[,**1**:&na+&nb]`;

x = beta0||t`||d`||sc`;

yx = y || x;

varNames = "replication1":"replication&replication" || "beta0"|| "t"|| "d" ||"sc";

create data from yx [colname=varNames];

append from yx;

close data;

beta = j(&replication,**4**);

se = j(&replication,**4**);

DO i = **1** TO &replication; /\*Run the regression for ith column (i.e. each replication)\*/

b = inv(x`\*x) \* x`\*y[,i];

yhat = x \* b;

sigmahat = (y[,i]-yhat)`\*(y[,i]-yhat)/(&na+&nb-**4**);

var\_beta = sigmahat\*inv(x`\*x);

beta[i,**1**] = b[**1**];

beta[i,**2**] = b[**2**];

beta[i,**3**] = b[**3**];

beta[i,**4**] = b[**4**];

se[i,**1**] = sqrt(var\_beta[**1**,**1**]);

se[i,**2**] = sqrt(var\_beta[**2**,**2**]);

se[i,**3**] = sqrt(var\_beta[**3**,**3**]);

se[i,**4**] = sqrt(var\_beta[**4**,**4**]);

END;

varNames = "OLS\_beta0":"OLS\_beta3";

create OLS\_beta from beta [colname=varNames];

append from beta;

close OLS\_beta;

meanbeta = mean(beta);

varNames = "OLS\_meanbeta0":"OLS\_meanbeta3";

create OLS\_meanbeta from meanbeta [colname=varNames];;

append from meanbeta;

close OLS\_meanbeta;

varNames = "OLS\_se0":"OLS\_se3";

create OLS\_se from se [colname=varNames];

append from se;

close OLS\_se;

meanse = mean(se);

varNames = "OLS\_meanse0":"OLS\_meanse3";

create OLS\_meanse from meanse [colname=varNames];

append from meanse;

close OLS\_meanse;

RMSE0 = sqrt(sum((beta[,**1**]-&beta0)##**2**)/&replication);

RMSE1 = sqrt(sum((beta[,**2**]-&beta1)##**2**)/&replication);

RMSE2 = sqrt(sum((beta[,**3**]-&beta2)##**2**)/&replication);

RMSE3 = sqrt(sum((beta[,**4**]-&beta3)##**2**)/&replication);

RMSE = RMSE0||RMSE1||RMSE2||RMSE3;

varNames = "OLS\_RMSE\_beta0":"OLS\_RMSE\_beta3";

create OLS\_beta\_RMSE from RMSE [colname=varNames];;

append from RMSE;

close OLS\_beta\_RMSE;

quit;

/\*Calculate the bias and relative bias of the Betas from OLS\*/

data OLS\_beta\_bias;

set OLS\_meanbeta;

OLS\_bias\_beta0=OLS\_meanbeta0-&beta0;

OLS\_bias\_beta1=OLS\_meanbeta1-&beta1;

OLS\_bias\_beta2=OLS\_meanbeta2-&beta2;

OLS\_bias\_beta3=OLS\_meanbeta3-&beta3;

OLS\_rbias\_beta1=OLS\_bias\_beta1/&beta1;

OLS\_rbias\_beta2=OLS\_bias\_beta2/&beta2;

OLS\_rbias\_beta3=OLS\_bias\_beta3/&beta3;

run;

/\*OLS: Calculate the bias and relative bias of the standard errors of Betas\*/

DATA OLS\_se\_bias;

MERGE OLS\_meanse complete\_OLS\_meanse&set.;

OLS\_bias\_sebeta0 = OLS\_meanse0-com\_OLS\_meanse0;

OLS\_bias\_sebeta1 = OLS\_meanse1-com\_OLS\_meanse1;

OLS\_bias\_sebeta2 = OLS\_meanse2-com\_OLS\_meanse2;

OLS\_bias\_sebeta3 = OLS\_meanse3-com\_OLS\_meanse3;

OLS\_rbias\_sebeta0 = OLS\_bias\_sebeta0/com\_OLS\_meanse0;

OLS\_rbias\_sebeta1 = OLS\_bias\_sebeta1/com\_OLS\_meanse1;

OLS\_rbias\_sebeta2 = OLS\_bias\_sebeta2/com\_OLS\_meanse2;

OLS\_rbias\_sebeta3 = OLS\_bias\_sebeta3/com\_OLS\_meanse3;

RUN;

b. SAS code for the results using an alternative method for the simplified model

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* Get covariance matrix from EM and \*/

/\* Use the method of least squares (simplified model) to estimate betas \*/

/\* from covariance matrix \*/ /\* \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

PROC MI data=na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi NIMPUTE=**0** NOPRINT;

EM ITPRINT OUTEM=outem OUT=miem\_data MAXITER=**500**;

VAR replication1 t d sc;

RUN;

/\* Add sample size to covariance matrix\*/

DATA temp;

\_TYPE\_ = 'N';

\_NAME\_='';

replication1=&na+&nb;

t=&na+&nb;

d=&na+&nb;

sc=&na+&nb;

RUN;

DATA outem2;

SET outem;

RUN;

PROC APPEND BASE=outem2 DATA=temp;

RUN;

/\* Add sample size to covariance matrix\*/

DATA temp;

\_TYPE\_ = 'N';

\_NAME\_='';

replication1=&na+&nb;

t=&na+&nb;

d=&na+&nb;

sc=&na+&nb;

RUN;

DATA outem2;

SET outem;

RUN;

PROC APPEND BASE=outem2 DATA=temp;

RUN;

/\*Run regression analysis using the EM output covariance matrix\*/

PROC REG DATA=outem2(TYPE=COV) NOPRINT OUTEST=ols\_est TABLEOUT;

MODEL replication1 = t d sc;

QUIT;

PROC IML;

USE ols\_est;

read all into A[colname=varNames];

beta = A[**1**, **2**:**5**];

varNames = "OLS\_COV\_beta0":"OLS\_COV\_beta3";

create OLS\_COV\_beta from beta [colname=varNames];

append from beta;

close OLS\_COV\_beta;

se = A[**2**, **2**:**5**];

varNames = "OLS\_COV\_se0":"OLS\_COV\_se3";

create OLS\_COV\_se from se [colname=varNames];

append from se;

close OLS\_COV\_se;

QUIT;

%DO r = **2** %TO &replication;

PROC MI data=na&na.\_nb&nb.\_r&replication.\_miss\_for\_mi NIMPUTE=**0** NOPRINT;

EM ITPRINT OUTEM=outem OUT=miem MAXITER=**500**;

VAR replication&r t d sc;

RUN;

DATA temp;

\_TYPE\_ = 'N';

\_NAME\_='';

replication&r=&na+&nb;

t=&na+&nb;

d=&na+&nb;

sc=&na+&nb;

RUN;

DATA outem2;

SET outem;

RUN;

PROC APPEND BASE=outem2 DATA=temp;

RUN;

PROC REG DATA=outem2(TYPE=COV) NOPRINT OUTEST=ols\_est TABLEOUT;

MODEL replication&r = t d sc;

QUIT;

PROC IML;

USE ols\_est;

read all into A[colname=varNames];

beta = A[**1**, **2**:**5**];

varNames = "OLS\_COV\_beta0":"OLS\_COV\_beta3";

create OLS\_COV\_beta\_tmp from beta [colname=varNames];

append from beta;

close OLS\_COV\_beta\_tmp;

se = A[**2**, **2**:**5**];

varNames = "OLS\_COV\_se0":"OLS\_COV\_se3";

create OLS\_COV\_se\_tmp from se [colname=varNames];

append from se;

close OLS\_COV\_se\_tmp;

QUIT;

DATA OLS\_COV\_beta;

SET OLS\_COV\_beta OLS\_COV\_beta\_tmp;

RUN;

DATA OLS\_COV\_se;

SET OLS\_COV\_se OLS\_COV\_se\_tmp;

RUN;

%END;

PROC MEANS DATA=OLS\_COV\_beta noprint;

VAR OLS\_COV\_beta0 OLS\_COV\_beta1 OLS\_COV\_beta2 OLS\_COV\_beta3;

output out=OLS\_COV\_meanbeta ;

RUN;

DATA OLS\_COV\_meanbeta;

SET OLS\_COV\_meanbeta;

IF \_STAT\_="MEAN";

RUN;

PROC MEANS DATA=OLS\_COV\_se noprint;

VAR OLS\_COV\_se0 OLS\_COV\_se1 OLS\_COV\_se2 OLS\_COV\_se3;

output out=OLS\_COV\_meanse ;

RUN;

DATA OLS\_COV\_meanse;

SET OLS\_COV\_meanse;

IF \_STAT\_="MEAN";

RUN;

/\*Calculate the bias and relative bias of the Betas estimated from EM covariance matrix\*/

data OLS\_COV\_beta\_bias;

set OLS\_COV\_meanbeta;

OLS\_COV\_bias\_beta0=OLS\_COV\_beta0-&beta0;

OLS\_COV\_bias\_beta1=OLS\_COV\_beta1-&beta1;

OLS\_COV\_bias\_beta2=OLS\_COV\_beta2-&beta2;

OLS\_COV\_bias\_beta3=OLS\_COV\_beta3-&beta3;

OLS\_COV\_rbias\_beta1=OLS\_COV\_bias\_beta1/&beta1;

OLS\_COV\_rbias\_beta2=OLS\_COV\_bias\_beta2/&beta2;

OLS\_COV\_rbias\_beta3=OLS\_COV\_bias\_beta3/&beta3;

run;

/\*RMSE of beta estimates\*/

PROC IML;

USE OLS\_COV\_beta;

read all into A[colname=varNames];

RMSE\_beta0 = sqrt(sum((A[,**1**]-&beta0)##**2**)/&replication);

RMSE\_beta1 = sqrt(sum((A[,**2**]-&beta1)##**2**)/&replication);

RMSE\_beta2 = sqrt(sum((A[,**3**]-&beta2)##**2**)/&replication);

RMSE\_beta3 = sqrt(sum((A[,**4**]-&beta3)##**2**)/&replication);

RMSE = RMSE\_beta0||RMSE\_beta1||RMSE\_beta2||RMSE\_beta3;

varNames = "OLS\_COV\_RMSE\_beta0":"OLS\_COV\_RMSE\_beta3";

create OLS\_COV\_beta\_RMSE from RMSE [colname=varNames];;

append from RMSE;

close OLS\_COV\_beta\_RMSE;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\*OLS from EM covariance matrix: Calculate the bias and relative bias of the /\*standard errors of Betas \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

DATA OLS\_COV\_se\_bias;

MERGE OLS\_COV\_meanse complete\_AR\_meanse&set.;

OLS\_COV\_bias\_sebeta0 = OLS\_COV\_se0-com\_AR\_se0;

OLS\_COV\_bias\_sebeta1 = OLS\_COV\_se1-com\_AR\_se1;

OLS\_COV\_bias\_sebeta2 = OLS\_COV\_se2-com\_AR\_se2;

OLS\_COV\_bias\_sebeta3 = OLS\_COV\_se3-com\_AR\_se3;

OLS\_COV\_rbias\_sebeta0 = OLS\_COV\_bias\_sebeta0/com\_AR\_se0;

OLS\_COV\_rbias\_sebeta1 = OLS\_COV\_bias\_sebeta1/com\_AR\_se1;

OLS\_COV\_rbias\_sebeta2 = OLS\_COV\_bias\_sebeta2/com\_AR\_se2;

OLS\_COV\_rbias\_sebeta3 = OLS\_COV\_bias\_sebeta3/com\_AR\_se3;

RUN;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* \*/

/\* Use lag-1 time-series model to estimate betas \*/

/\* for imputed data for each replication \*/ /\* \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

PROC AUTOREG DATA=data OUTEST=parest COVOUT NOPRINT;

MODEL replication1 = t d sc / nlag=**1**;

RUN;

PROC IML;

USE parest;

read all into A[colname=varNames];

beta = A[**1**,**4**] || A[**1**, **6**:**8**];

varNames = "AR\_beta0":"AR\_beta3";

create AR\_beta from beta [colname=varNames];

append from beta;

close AR\_beta;

se = A[**2**:**5**, **3**]`;

varNames = "AR\_se0":"AR\_se3";

create AR\_se from se [colname=varNames];

append from se;

close AR\_se;

QUIT;

%DO r = **2** %TO &replication;

PROC AUTOREG DATA=data OUTEST=parest COVOUT NOPRINT;

MODEL replication&r = t d sc / nlag=**1**;

RUN;

PROC IML;

USE parest;

read all into A[colname=varNames];

beta = A[**1**,**4**] || A[**1**, **6**:**8**];

varNames = "AR\_beta0":"AR\_beta3";

create AR\_beta\_tmp from beta [colname=varNames];

append from beta;

close AR\_beta\_tmp;

se = A[**2**:**5**, **3**]`;

varNames = "AR\_se0":"AR\_se3";

create AR\_se\_tmp from se [colname=varNames];

append from se;

close AR\_se\_tmp;

QUIT;

DATA AR\_beta;

SET AR\_beta AR\_beta\_tmp;

RUN;

DATA AR\_se;

SET AR\_se AR\_se\_tmp;

RUN;

%END;

PROC MEANS DATA=AR\_beta noprint;

VAR AR\_beta0 AR\_beta1 AR\_beta2 AR\_beta3;

output out=AR\_meanbeta ;

RUN;

DATA AR\_meanbeta;

SET AR\_meanbeta;

IF \_STAT\_="MEAN";

RUN;

PROC MEANS DATA=AR\_se noprint;

VAR AR\_se0 AR\_se1 AR\_se2 AR\_se3;

output out=AR\_meanse ;

RUN;

DATA AR\_meanse(keep = AR\_se0 AR\_se1 AR\_se2 AR\_se3);

SET AR\_meanse;

IF \_STAT\_="MEAN";

RUN;

/\*Calculate the bias and relative bias of the Betas for complete data Autoreg\*/

data AR\_beta\_bias;

set AR\_meanbeta;

AR\_bias\_beta0=AR\_beta0-&beta0;

AR\_bias\_beta1=AR\_beta1-&beta1;

AR\_bias\_beta2=AR\_beta2-&beta2;

AR\_bias\_beta3=AR\_beta3-&beta3;

AR\_rbias\_beta1=AR\_bias\_beta1/&beta1;

AR\_rbias\_beta2=AR\_bias\_beta2/&beta2;

AR\_rbias\_beta3=AR\_bias\_beta3/&beta3;

run;

/\*RMSE of beta estimates\*/

PROC IML;

USE AR\_beta;

read all into A[colname=varNames];

RMSE\_beta0 = sqrt(sum((A[,**1**]-&beta0)##**2**)/&replication);

RMSE\_beta1 = sqrt(sum((A[,**2**]-&beta1)##**2**)/&replication);

RMSE\_beta2 = sqrt(sum((A[,**3**]-&beta2)##**2**)/&replication);

RMSE\_beta3 = sqrt(sum((A[,**4**]-&beta3)##**2**)/&replication);

RMSE = RMSE\_beta0||RMSE\_beta1||RMSE\_beta2||RMSE\_beta3;

varNames = "AR\_RMSE\_beta0":"AR\_RMSE\_beta3";

create AR\_beta\_RMSE from RMSE [colname=varNames];;

append from RMSE;

close AR\_beta\_RMSE;

/\*AR: Calculate the bias and relative bias of the standard errors of Betas\*/

DATA AR\_se\_bias;

MERGE AR\_meanse complete\_AR\_meanse&set.;

AR\_bias\_sebeta0 = AR\_se0-com\_AR\_se0;

AR\_bias\_sebeta1 = AR\_se1-com\_AR\_se1;

AR\_bias\_sebeta2 = AR\_se2-com\_AR\_se2;

AR\_bias\_sebeta3 = AR\_se3-com\_AR\_se3;

AR\_rbias\_sebeta0 = AR\_bias\_sebeta0/com\_AR\_se0;

AR\_rbias\_sebeta1 = AR\_bias\_sebeta1/com\_AR\_se1;

AR\_rbias\_sebeta2 = AR\_bias\_sebeta2/com\_AR\_se2;

AR\_rbias\_sebeta3 = AR\_bias\_sebeta3/com\_AR\_se3;

RUN;

DATA bias\_RMSE&dataseq.;

MERGE OLS\_beta\_bias (KEEP=OLS\_bias\_beta0 OLS\_bias\_beta1 OLS\_bias\_beta2 OLS\_bias\_beta3

OLS\_rbias\_beta1 OLS\_rbias\_beta2 OLS\_rbias\_beta3)

OLS\_beta\_RMSE

AR\_beta\_bias (KEEP=AR\_bias\_beta0 AR\_bias\_beta1 AR\_bias\_beta2 AR\_bias\_beta3

AR\_rbias\_beta1 AR\_rbias\_beta2 AR\_rbias\_beta3)

AR\_beta\_RMSE OLS\_se\_bias AR\_se\_bias;

phil = &phil;

missrate\_1= &missrate\_1;

missrate\_2= &missrate\_2;

missrate = (missrate\_1 + missrate\_2)/**2**;

beta0=&beta0;

beta1=&beta1;

beta2=&beta2;

beta3=&beta3;

RUN;

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* \*/

/\* \*/

/\* Merge data for performing ANOVA to estimate the effects of \*/

/\* manipulated variables \*/ /\* \*/

/\* \*/

/\* \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

DATA outdata&dataseq.;

MERGE na&na.\_nb&nb.\_r&replication(keep=phil missrate beta0 beta1 beta2 beta3)

OLS\_beta AR\_beta;

RUN;

%END;

**%MEND**;

II. Examples for the short intervention phase (*n*A =10, *n*B=10)

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* Users need to change the number of the parameters below to reflect \*/ /\* the study design. \*/

/\* Once the MACRO above has been run once in SAS, only the SAS comments \*/ /\* below is needed for each condition. \*/

/\* If several study designs are needed, users can stagger the SAS \*/

/\* comments below to run the program consecutively. \*/

/\* As we mentioned earlier, \*/

/\* Parameters for the MACRO include \*/

/\* dataseq = a variable created for combining results from ANOVA, \*/

/\* replication = number of replication, \*/ /\* set = the index for autocorrelation conditions, used to match \*/

/\* incomplete conditions with the corresponding complete conditions. \*/

/\* phil = the true value of lag-1 autocorrelation, \*/

/\* beta0 = the true value of beta0, \*/ /\* beta1 = the true value of beta1, \*/

/\* beta2 = the true value of beta2, \*/

/\* beta3 = the true value of beta3, \*/ /\* missrate\_1 = manipulated missing rate for phase A, \*/ /\* missrate\_2 = manipulated missing rate for phase B, \*/ /\* Allow\_miss\_na = acceptable number of missing scores in phase A, \*/ /\* Allow\_miss\_nb= acceptable number of missing scores in phase B, \*/

/\* na= the number of scores in phase A, \*/

/\* nb= the number of scores in phase B, \*/

/\* nb\_first =the session number of the first score in phase B, \*/

/\* nb\_last = the session number of the last score in phase B, and \*/

/\* seed = seed number. \*/

/\* \*/

/\* Below we include four examples for the short intervention phase \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

%***SCDMissing***(dataseq=**58**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1**, missrate\_1=**0**, missrate\_2=**0**, Allow\_miss\_na=**0**, Allow\_miss\_nb=**0**, na=**10**, nb=**10**, nb\_first=**11**, nb\_last=**20**,seed=**123**);

%***SCDMissing***(dataseq=**1**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.0001**, missrate\_2=**.1**, Allow\_miss\_na=**0**, Allow\_miss\_nb=**1**, nA =**10**, nB =**10**, nb\_first=**11**, nb\_last=**20**, seed=**123**);

%***SCDMissing***(dataseq=**2**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.1**, missrate\_2=**.2**, Allow\_miss\_na=**1**, Allow\_miss\_nb=**2**, nA =**10**, nB =**10**, nb\_first=**11**, nb\_last=**20**, seed=**123**);

%***SCDMissing***(dataseq=**3**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.2**, missrate\_2=**.3**, Allow\_miss\_na=**2**, Allow\_miss\_nb=**3**, nA =**10**, nB =**10**, nb\_first=**11**, nb\_last=**20**, seed=**123**);

III. Examples for the long intervention phase (*n*A =10, *n*B=56)

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* Users need to change the number of the parameters below to reflect \*/ /\* the study design. \*/

/\* Once the MACRO above has been run once in SAS, only the SAS comments \*/ /\* below is needed for each condition. \*/

/\* If several study designs are needed, users can stagger the SAS \*/

/\* comments below to run the program consecutively. \*/

/\* As we mentioned earlier, \*/

/\* Parameters for the MACRO include \*/

/\* dataseq = a variable created for combining results from ANOVA, \*/

/\* replication = number of replication, \*/ /\* set = the index for autocorrelation conditions, used to match \*/

/\* incomplete conditions with the corresponding complete conditions. \*/

/\* phil = the true value of lag-1 autocorrelation, \*/

/\* beta0 = the true value of beta0, \*/ /\* beta1 = the true value of beta1, \*/

/\* beta2 = the true value of beta2, \*/

/\* beta3 = the true value of beta3, \*/ /\* missrate\_1 = manipulated missing rate for phase A, \*/ /\* missrate\_2 = manipulated missing rate for phase B, \*/ /\* Allow\_miss\_na = acceptable number of missing scores in phase A, \*/ /\* Allow\_miss\_nb= acceptable number of missing scores in phase B, \*/

/\* na= the number of scores in phase A, \*/

/\* nb= the number of scores in phase B, \*/

/\* nb\_first =the session number of the first score in phase B, \*/

/\* nb\_last = the session number of the last score in phase B, and \*/

/\* seed = seed number. \*/

/\* \*/

/\* Below we include four examples for the long intervention phase \*/

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

%***SCDMissing***(dataseq=**58**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1**, missrate\_1=**0**, missrate\_2=**0**, Allow\_miss\_na=**0**, Allow\_miss\_nb=**0**, na=**10**, nb=**56**, nb\_first=**11**, nb\_last=**66**,seed=**123**);

%***SCDMissing***(dataseq=**1**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.0001**, missrate\_2=**.1**, Allow\_miss\_na=**0**, Allow\_miss\_nb=**1**, nA =**10**, nB =**56**, nb\_first=**11**, nb\_last=**66**, seed=**123**);

%***SCDMissing***(dataseq=**2**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.1**, missrate\_2=**.2**, Allow\_miss\_na=**1**, Allow\_miss\_nb=**2**, nA =**10**, nB =**56**, nb\_first=**11**, nb\_last=**66**, seed=**123**);

%***SCDMissing***(dataseq=**3**, replication=**10000**, set=**1**, phil=-**0.9**, beta0=**0** , beta1= **0.1**, beta2= **0.1**, beta3=**0.1** , missrate\_1=**.2**, missrate\_2=**.3**, Allow\_miss\_na=**2**, Allow\_miss\_nb=**3**, nA =**10**, nB =**56**, nb\_first=**11**, nb\_last=**66**, seed=**123**);

3. Figures and ANOVA results obtained from β1 = β2 = β3 = 0.1, paired with a short intervention phase (*n*A =10, *n*B=10)

I. RB

Figure. RB of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00152048 | 0.00008447 | 278.29 | <.0001 | 0.3276\* |
| Missing Rate (MR) | 2 | 0.00217131 | 0.00108565 | 3576.68 | <.0001 | 0.4679\* |
| Model Fitting (MF) | 1 | 0.00000198 | 0.00000198 | 6.53 | 0.0150 | 0.0004 |
| A\*MR | 36 | 0.00091159 | 0.00002532 | 83.42 | <.0001 | 0.1964 |
| A\*MF | 18 | 0.00001202 | 0.00000067 | 2.20 | 0.0216 | 0.0026 |
| MR\*MF | 2 | 0.00001256 | 0.00000628 | 20.70 | <.0001 | 0.0027 |
| Error | 36 | 0.00001093 | 0.00000030 |  |  |  |

\**p* < .05 and η2 ≥ .06

Figure. RB of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.04596551** | **0.00255364** | **43.65** | **<.0001** | **0.2156\*** |
| **Missing Rate (MR)** | **2** | **0.08385168** | **0.04192584** | **716.73** | **<.0001** | **0.3934\*** |
| Model Fitting (MF) | 1 | 0.00011456 | 0.00011456 | 1.96 | 0.1702 | 0.0005 |
| **A\*MR** | **36** | **0.07832515** | **0.00217570** | **37.19** | **<.0001** | **0.3675\*** |
| A\*MF | 18 | 0.00038456 | 0.00002136 | 0.37 | 0.9872 | 0.0018 |
| MR\*MF | 2 | 0.00240222 | 0.00120111 | 20.53 | <.0001 | 0.0113 |
| Error | 36 | 0.00210586 | 0.00005850 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RB of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00271562 | 0.00015087 | 319.36 | <.0001 | 0.3319**\*** |
| Missing Rate (MR) | 2 | 0.00370797 | 0.00185399 | 3924.56 | <.0001 | 0.4531\* |
| Model Fitting (MF) | 1 | 0.00000441 | 0.00000441 | 9.34 | 0.0042 | 0.0005 |
| A\*MR | 36 | 0.00171098 | 0.00004753 | 100.61 | <.0001 | 0.2091\* |
| A\*MF | 18 | 0.00002247 | 0.00000125 | 2.64 | 0.0064 | 0.0027 |
| MR\*MF | 2 | 0.00000436 | 0.00000218 | 4.62 | 0.0164 | 0.0005 |
| Error | 36 | 0.00001701 | 0.00000047 |  |  |  |

\**p* < .05 and η2 ≥ .06

II. RMSE

Figure. RMSE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11739909 | 0.00652217 | 2224.94 | <.0001 | 0.9195\* |
| Missing Rate (MR) | 2 | 0.00726465 | 0.00363232 | 1239.12 | <.0001 | 0.0569\* |
| Model Fitting (MF) | 1 | 0.00018147 | 0.00018147 | 61.90 | <.0001 | 0.0014 |
| A\*MR | 36 | 0.00214168 | 0.00005949 | 20.29 | <.0001 | 0.0168 |
| A\*MF | 18 | 0.00053527 | 0.00002974 | 10.14 | <.0001 | 0.0042 |
| MR\*MF | 2 | 0.00004357 | 0.00002178 | 7.43 | 0.0020 | 0.0003 |
| Error | 36 | 0.00010553 | 0.00000293 |  |  |  |

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **4.20373490** | **0.23354083** | **1220.73** | **<.0001** | **0.8552\*** |
| **Missing Rate (MR)** | **2** | **0.55208930** | **0.27604465** | **1442.90** | **<.0001** | **0.1123\*** |
| Model Fitting (MF) | 1 | 0.02554601 | 0.02554601 | 133.53 | <.0001 | 0.0052 |
| A\*MR | 36 | 0.07147893 | 0.00198553 | 10.38 | <.0001 | 0.0145 |
| A\*MF | 18 | 0.04991400 | 0.00277300 | 14.49 | <.0001 | 0.0102 |
| MR\*MF | 2 | 0.00580562 | 0.00290281 | 15.17 | <.0001 | 0.0012 |
| Error | 36 | 0.00688724 | 0.00019131 |  |  |  |

*Note*. Unacceptable RMSEs are those above the bold reference line at RMSE = 1.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.30844362 | 0.01713576 | 33672.4 | <.0001 | 0.9401\* |
| Missing Rate (MR) | 2 | 0.01441552 | 0.00720776 | 14163.5 | <.0001 | 0.0439 |
| Model Fitting (MF) | 1 | 0.00003584 | 0.00003584 | 70.43 | <.0001 | 0.0001 |
| A\*MR | 36 | 0.00509358 | 0.00014149 | 278.03 | <.0001 | 0.0155 |
| A\*MF | 18 | 0.00007209 | 0.00000400 | 7.87 | <.0001 | 0.0002 |
| MR\*MF | 2 | 0.00001155 | 0.00000577 | 11.35 | 0.0002 | 0.0000 |
| Error | 36 | 0.00001832 | 0.00000051 |  |  |  |

\**p* < .05 and η2 ≥ .06

III. RBESE

Figure. RBESE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **16.54418241** | **0.91912125** | **123.54** | **<.0001** | **0.6011\*** |
| Missing Rate (MR) | 2 | 0.39925069 | 0.19962535 | 26.83 | <.0001 | 0.0145 |
| **Model Fitting (MF)** | **1** | **3.05994960** | **3.05994960** | **411.29** | **<.0001** | **0.1112\*** |
| A\*MR | 36 | 0.01750825 | 0.00048634 | 0.07 | 1.0000 | 0.0006 |
| **A\*MF** | **18** | **7.17192951** | **0.39844053** | **53.56** | **<.0001** | **0.2606\*** |
| MR\*MF | 2 | 0.06301170 | 0.03150585 | 4.23 | 0.0223 | 0.0023 |
| Error | 36 | 0.26783412 | 0.00743984 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **15.42734624** | **0.85707479** | **122.15** | **<.0001** | **0.6012\*** |
| Missing Rate (MR) | 2 | 0.38270059 | 0.19135029 | 27.27 | <.0001 | 0.0149 |
| **Model Fitting (MF)** | **1** | **2.93198046** | **2.93198046** | **417.86** | **<.0001** | **0.1143\*** |
| A\*MR | 36 | 0.01774337 | 0.00049287 | 0.07 | 1.0000 | 0.0007 |
| **A\*MF** | **18** | **6.58073033** | **0.36559613** | **52.10** | **<.0001** | **0.2564\*** |
| MR\*MF | 2 | 0.06945999 | 0.03472999 | 4.95 | 0.0126 | 0.0027 |
| Error | 36 | 0.25259807 | 0.00701661 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **18.47871692** | **1.02659538** | **126.55** | **<.0001** | **0.5957\*** |
| Missing Rate (MR) | 2 | .41532957 | 0.20766479 | 25.60 | <.0001 | 0.0134 |
| **Model Fitting (MF)** | **1** | **.48231959** | **3.48231959** | **429.28** | **<.0001** | **0.1123\*** |
| A\*MR | 36 | 0.01658172 | 0.00046060 | 0.06 | 1.0000 | 0.0005 |
| **A\*MF** | **18** | **8.27148646** | **0.45952703** | **56.65** | **<.0001** | **0.2667\*** |
| MR\*MF | 2 | 0.06301814 | 0.03150907 | 3.88 | 0.0297 | 0.0020 |
| Error | 36 | 0.29203468 | 0.00811207 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

4. Figures and ANOVA results obtained from β1 = β2 = β3 = 0.1, paired with a long intervention phase (*n*A =10, *n*B = 56)

I. RB

Figure. RB of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00261895 | 0.00014550 | 124.82 | <.0001 | 0.1551\* |
| Missing Rate (MR) | 2 | 0.01201010 | 0.00600505 | 5151.53 | <.0001 | 0.7115\* |
| Model Fitting (MF) | 1 | 0.00000055 | 0.00000055 | 0.47 | 0.4964 | 0.0000 |
| A\*MR | 36 | 0.00212087 | 0.00005891 | 50.54 | <.0001 | 0.1256\* |
| A\*MF | 18 | 0.00005757 | 0.00000320 | 2.74 | 0.0049 | 0.0034 |
| MR\*MF | 2 | 0.00003100 | 0.00001550 | 13.30 | <.0001 | 0.0018 |
| Error | 36 | 0.00004196 | 0.00000117 |  |  |  |

\**p* < .05 and η2 ≥ .06

Figure. RB of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.15329519** | **0.00851640** | **180.08** | **<.0001** | **0.1455\*** |
| **Missing Rate (MR)** | **2** | **0.81583150** | **0.40791575** | **8625.29** | **<.0001** | **0.7742\*** |
| Model Fitting (MF) | 1 | 0.00001399 | 0.00001399 | 0.30 | 0.5898 | 0.0000 |
| **A\*MR** | **36** | **0.07879269** | **0.00218869** | **46.28** | **<.0001** | **0.0748\*** |
| A\*MF | 18 | 0.00312611 | 0.00017367 | 3.67 | 0.0004 | 0.0030 |
| MR\*MF | 2 | 0.00102269 | 0.00051134 | 10.81 | 0.0002 | 0.0010 |
| Error | 36 | 0.00170255 | 0.00004729 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RB of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00215938 | 0.00011997 | 101.86 | <.0001 | 0.1257\* |
| Missing Rate (MR) | 2 | 0.01257764 | 0.00628882 | 5339.79 | <.0001 | 0.7319\* |
| Model Fitting (MF) | 1 | 0.00000050 | 0.00000050 | 0.43 | 0.5169 | 0.0000 |
| A\*MR | 36 | 0.00231841 | 0.00006440 | 54.68 | <.0001 | 0.1349\* |
| A\*MF | 18 | 0.00005761 | 0.00000320 | 2.72 | 0.0052 | 0.0034 |
| MR\*MF | 2 | 0.00002933 | 0.00001466 | 12.45 | <.0001 | 0.0017 |
| Error | 36 | 0.00004240 | 0.00000118 |  |  |  |

\**p* < .05 and η2 ≥ .06

II. RMSE

Figure. RMSE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.10883733 | 0.00604652 | 2067.74 | <.0001 | 0.9118\* |
| Missing Rate (MR) | 2 | 0.00722489 | 0.00361244 | 1235.36 | <.0001 | 0.0605\* |
| Model Fitting (MF) | 1 | 0.00084690 | 0.00084690 | 289.62 | <.0001 | 0.0071 |
| A\*MR | 36 | 0.00152285 | 0.00004230 | 14.47 | <.0001 | 0.0128 |
| A\*MF | 18 | 0.00072487 | 0.00004027 | 13.77 | <.0001 | 0.0061 |
| MR\*MF | 2 | 0.00010094 | 0.00005047 | 17.26 | <.0001 | 0.0008 |
| Error | 36 | 0.00010527 | 0.00000292 |  |  |  |

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RMSEs are those above the bold reference line at RMSE = 1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **5.24888738** | **0.29160485** | **513.77** | **<.0001** | **0.8728\*** |
| **Missing Rate (MR)** | **2** | **0.34611077** | **0.17305539** | **304.90** | **<.0001** | **0.0576\*** |
| Model Fitting (MF) | 1 | 0.13008746 | 0.13008746 | 229.20 | <.0001 | 0.0216 |
| A\*MR | 36 | 0.04320059 | 0.00120002 | 2.11 | 0.0137 | 0.0072 |
| A\*MF | 18 | 0.21160644 | 0.01175591 | 20.71 | <.0001 | 0.0352 |
| MR\*MF | 2 | 0.01335425 | 0.00667712 | 11.76 | 0.0001 | 0.0022 |
| Error | 36 | 0.02043276 | 0.00056758 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11850198 | 0.00658344 | 2453.97 | <.0001 | 0.9203\* |
| Missing Rate (MR) | 2 | 0.00715450 | 0.00357725 | 1333.42 | <.0001 | 0.0556\* |
| Model Fitting (MF) | 1 | 0.00071530 | 0.00071530 | 266.63 | <.0001 | 0.0056 |
| A\*MR | 36 | 0.00158943 | 0.00004415 | 16.46 | <.0001 | 0.0123 |
| A\*MF | 18 | 0.00062213 | 0.00003456 | 12.88 | <.0001 | 0.0048 |
| MR\*MF | 2 | 0.00008905 | 0.00004452 | 16.60 | <.0001 | 0.0007 |
| Error | 36 | 0.00009658 | 0.00000268 |  |  |  |

\**p* < .05 and η2 ≥ .06

III. RBESE

Figure. RBESE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **19.79439981** | **1.09968888** | **147.64** | **<.0001** | **0.6519\*** |
| Missing Rate (MR) | 2 | 0.26118792 | 0.13059396 | 17.53 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.75048581** | **1.75048581** | **235.01** | **<.0001** | **0.0577\*** |
| A\*MR | 36 | 0.01345881 | 0.00037386 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.21460335** | **0.45636685** | **61.27** | **<.0001** | **0.2706\*** |
| MR\*MF | 2 | 0.06012317 | 0.03006158 | 4.04 | 0.0262 | 0.0020 |
| Error | 36 | 0.26814757 | 0.00744854 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.03139940** | **1.11285552** | **149.54** | **<.0001** | **0.6380\*** |
| Missing Rate (MR) | 2 | 0.24679612 | 0.12339806 | 16.58 | <.0001 | 0.0079 |
| **Model Fitting (MF)** | **1** | **2.04679561** | **2.04679561** | **275.03** | **<.0001** | **0.0652\*** |
| A\*MR | 36 | 0.01359083 | 0.00037752 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.70921942** | **0.48384552** | **65.01** | **<.0001** | **0.2774\*** |
| MR\*MF | 2 | 0.08039696 | 0.04019848 | 5.40 | 0.0089 | 0.0026 |
| Error | 36 | 0.26791540 | 0.00744209 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.18989032** | **1.12166057** | **147.72** | **<.0001** | **0.6535\*** |
| Missing Rate (MR) | 2 | 0.26440007 | 0.13220004 | 17.41 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.73754304** | **1.73754304** | **228.83** | **<.0001** | **0.0562\*** |
| A\*MR | 36 | 0.01357025 | 0.00037695 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.35692343** | **0.46427352** | **61.14** | **<.0001** | **0.2705\*** |
| MR\*MF | 2 | 0.05741628 | 0.02870814 | 3.78 | 0.0323 | 0.0019 |
| Error | 36 | 0.27335607 | 0.00759322 |  |  |  |

*Note*. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

5. Figures and ANOVA results from other specifications of βs

I. β1 = 1, β2 =0.1, β3 = 0.1 paired with a short intervention phase (*n*A=10, *n*B=10)

a. RB

Figure. RB of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00001520 | 0.00000084 | 278.58 | <.0001 | 0.3269\* |
| Missing Rate (MR) | 2 | 0.00002181 | 0.00001091 | 3596.88 | <.0001 | 0.4690\* |
| Model Fitting (MF) | 1 | 0.00000002 | 0.00000002 | 6.55 | 0.0148 | 0.0004 |
| A\*MR | 36 | 0.00000911 | 0.00000025 | 83.48 | <.0001 | 0.1936\* |
| A\*MF | 18 | 0.00000012 | 0.00000001 | 2.21 | 0.0213 | 0.0026 |
| MR\*MF | 2 | 0.00000013 | 0.00000006 | 20.76 | <.0001 | 0.0027 |
| Error | 36 | 0.00000011 | 0.00000000 |  |  |  |

*Note*. Type I SS and Mean Square of missing rate, autocorrelation, model fitting and their two-way interactions on relative bias for β1 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Therefore, the *F* values and *p* values of missing rate, autocorrelation, model fitting and their two-way interactions on relative bias for β1 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RB of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.04594270** | **0.00255237** | **43.59** | **<.0001** | **0.2155\*** |
| **Missing Rate (MR)** | **2** | **0.08389566** | **0.04194783** | **716.34** | **<.0001** | **0.3935\*** |
| Model Fitting (MF) | 1 | 0.00011516 | 0.00011516 | 1.97 | 0.1694 | 0.0005 |
| **A\*MR** | **36** | **0.07834635** | **0.00217629** | **37.16** | **<.0001** | **0.3675\*** |
| A\*MF | 18 | 0.00038497 | 0.00002139 | 0.37 | 0.9872 | 0.0018 |
| MR\*MF | 2 | 0.00240772 | 0.00120386 | 20.56 | <.0001 | 0.0113 |
| Error | 36 | 0.00210811 | 0.00005856 |  |  |  |

*Note*. The results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RB of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00272209 | 0.00015123 | 319.28 | <.0001 | 0.3340\* |
| Missing Rate (MR) | 2 | 0.00366811 | 0.00183405 | 3872.11 | <.0001 | 0.4501\* |
| Model Fitting (MF) | 1 | 0.00000437 | 0.00000437 | 9.23 | 0.0044 | 0.0005 |
| A\*MR | 36 | 0.00171126 | 0.00004754 | 100.36 | <.0001 | 0.2100\* |
| A\*MF | 18 | 0.00002243 | 0.00000125 | 2.63 | 0.0066 | 0.0028 |
| MR\*MF | 2 | 0.00000438 | 0.00000219 | 4.62 | 0.0163 | 0.0005 |
| Error | 36 | 0.00001705 | 0.00000047 |  |  |  |

*Note*. The results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

### b. RMSE

Figure. RMSE of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11739909 | 0.00652217 | 2224.94 | <.0001 | 0.9195\* |
| Missing Rate (MR) | 2 | 0.00726465 | 0.00363232 | 1239.12 | <.0001 | 0.0569\* |
| Model Fitting (MF) | 1 | 0.00018147 | 0.00018147 | 61.90 | <.0001 | 0.0014 |
| A\*MR | 36 | 0.00214168 | 0.00005949 | 20.29 | <.0001 | 0.0168 |
| A\*MF | 18 | 0.00053527 | 0.00002974 | 10.14 | <.0001 | 0.0042 |
| MR\*MF | 2 | 0.00004357 | 0.00002178 | 7.43 | 0.0020 | 0.0003 |
| Error | 36 | 0.00010553 | 0.00000293 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **4.20354658** | **0.23353037** | **1220.49** | **<.0001** | **0.8552\*** |
| **Missing Rate (MR)** | **2** | **0.55203308** | **0.27601654** | **1442.54** | **<.0001** | **0.1123\*** |
| Model Fitting (MF) | 1 | 0.02554451 | 0.02554451 | 133.50 | <.0001 | 0.0052 |
| A\*MR | 36 | 0.07148664 | 0.00198574 | 10.38 | <.0001 | 0.0145 |
| A\*MF | 18 | 0.04991264 | 0.00277292 | 14.49 | <.0001 | 0.0102 |
| MR\*MF | 2 | 0.00580465 | 0.00290233 | 15.17 | <.0001 | 0.0012 |
| Error | 36 | 0.00688828 | 0.00019134 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.30844281 | 0.01713571 | 33673.2 | <.0001 | 0.9401\* |
| Missing Rate (MR) | 2 | 0.01441577 | 0.00720788 | 14164.1 | <.0001 | 0.0439 |
| Model Fitting (MF) | 1 | 0.00003580 | 0.00003580 | 70.34 | <.0001 | 0.0001 |
| A\*MR | 36 | 0.00509423 | 0.00014151 | 278.07 | <.0001 | 0.0155 |
| A\*MF | 18 | 0.00007209 | 0.00000400 | 7.87 | <.0001 | 0.0002 |
| MR\*MF | 2 | 0.00001156 | 0.00000578 | 11.35 | 0.0002 | 0.0000 |
| Error | 36 | 0.00001832 | 0.00000051 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **16.54418241** | **0.91912125** | **123.54** | **<.0001** | **0.6011\*** |
| Missing Rate (MR) | 2 | 0.39925069 | 0.19962535 | 26.83 | <.0001 | 0.0145 |
| **Model Fitting (MF)** | **1** | **3.05994960** | **3.05994960** | **411.29** | **<.0001** | **0.1112\*** |
| A\*MR | 36 | 0.01750825 | 0.00048634 | 0.07 | 1.0000 | 0.0006 |
| **A\*MF** | **18** | **7.17192951** | **0.39844053** | **53.56** | **<.0001** | **0.2606\*** |
| MR\*MF | 2 | 0.06301170 | 0.03150585 | 4.23 | 0.0223 | 0.0023 |
| Error | 36 | 0.26783412 | 0.00743984 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **15.42734624** | **0.85707479** | **122.15** | **<.0001** | **0.6012\*** |
| Missing Rate (MR) | 2 | 0.38270059 | 0.19135029 | 27.27 | <.0001 | 0.0149 |
| **Model Fitting (MF)** | **1** | **2.93198046** | **2.93198046** | **417.86** | **<.0001** | **0.1143\*** |
| A\*MR | 36 | 0.01774337 | 0.00049287 | 0.07 | 1.0000 | 0.0007 |
| **A\*MF** | **18** | **6.58073033** | **0.36559613** | **52.10** | **<.0001** | **0.2564\*** |
| MR\*MF | 2 | 0.06945999 | 0.03472999 | 4.95 | 0.0126 | 0.0027 |
| Error | 36 | 0.25259807 | 0.00701661 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **18.47871692** | **1.02659538** | **126.55** | **<.0001** | **0.5957\*** |
| Missing Rate (MR) | 2 | 0.41532957 | 0.20766479 | 25.60 | <.0001 | 0.0134 |
| **Model Fitting (MF)** | **1** | **3.48231959** | **3.48231959** | **429.28** | **<.0001** | **0.1123\*** |
| A\*MR | 36 | 0.01658172 | 0.00046060 | 0.06 | 1.0000 | 0.0005 |
| **A\*MF** | **18** | **8.27148646** | **0.45952703** | **56.65** | **<.0001** | **0.2667\*** |
| MR\*MF | 2 | 0.06301814 | 0.03150907 | 3.88 | 0.0297 | 0.0020 |
| Error | 36 | 0.29203468 | 0.00811207 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

II. β1 = 0.1, β2 = 1, β3 = 0.1 paired with a short intervention phase (*n*A=10, *n*B=10)

a. RB

Figure. RB of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00152046 | 0.00008447 | 278.30 | <.0001 | 0.3276\* |
| Missing Rate (MR) | 2 | 0.00217105 | 0.00108552 | 3576.38 | <.0001 | 0.4678\* |
| Model Fitting (MF) | 1 | 0.00000199 | 0.00000199 | 6.54 | 0.0149 | 0.0004 |
| A\*MR | 36 | 0.00091155 | 0.00002532 | 83.42 | <.0001 | 0.1964\* |
| A\*MF | 18 | 0.00001203 | 0.00000067 | 2.20 | 0.0216 | 0.0026 |
| MR\*MF | 2 | 0.00001257 | 0.00000628 | 20.70 | <.0001 | 0.0027 |
| Error | 36 | 0.00001093 | 0.00000030 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RB of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00045978 | 0.00002554 | 43.66 | <.0001 | 0.2157\* |
| Missing Rate (MR) | 2 | 0.00083891 | 0.00041945 | 717.04 | <.0001 | 0.3935\* |
| Model Fitting (MF) | 1 | 0.00000115 | 0.00000115 | 1.97 | 0.1694 | 0.0005 |
| A\*MR | 36 | 0.00078308 | 0.00002175 | 37.18 | <.0001 | 0.3673\* |
| A\*MF | 18 | 0.00000385 | 0.00000021 | 0.37 | 0.9872 | 0.0018 |
| MR\*MF | 2 | 0.00002402 | 0.00001201 | 20.53 | <.0001 | 0.0113 |
| Error | 36 | 0.00002106 | 0.00000058 |  |  |  |

*Note*. Type I SS and Mean Square of missing rate, autocorrelation, and their interaction on relative bias for β2 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Therefore, the F values and p values of missing rate, autocorrelation, and their interaction on relative bias for β3 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RB of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00271725 | 0.00015096 | 319.42 | <.0001 | 0.3319\* |
| Missing Rate (MR) | 2 | 0.00371069 | 0.00185534 | 3925.81 | <.0001 | 0.4532\* |
| Model Fitting (MF) | 1 | 0.00000441 | 0.00000441 | 9.33 | 0.0042 | 0.0005 |
| A\*MR | 36 | 0.00171125 | 0.00004753 | 100.58 | <.0001 | 0.2090\* |
| A\*MF | 18 | 0.00002248 | 0.00000125 | 2.64 | 0.0064 | 0.0027 |
| MR\*MF | 2 | 0.00000437 | 0.00000218 | 4.62 | 0.0164 | 0.0005 |
| Error | 36 | 0.00001701 | 0.00000047 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

### b. RMSE

Figure. RMSE of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11739909 | 0.00652217 | 2224.94 | <.0001 | 0.9195\* |
| Missing Rate (MR) | 2 | 0.00726465 | 0.00363232 | 1239.12 | <.0001 | 0.0569\* |
| Model Fitting (MF) | 1 | 0.00018147 | 0.00018147 | 61.90 | <.0001 | 0.0014 |
| A\*MR | 36 | 0.00214168 | 0.00005949 | 20.29 | <.0001 | 0.0168 |
| A\*MF | 18 | 0.00053527 | 0.00002974 | 10.14 | <.0001 | 0.0042 |
| MR\*MF | 2 | 0.00004357 | 0.00002178 | 7.43 | 0.0020 | 0.0003 |
| Error | 36 | 0.00010553 | 0.00000293 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **4.20369860** | **0.23353881** | **1220.63** | **<.0001** | **0.8552\*** |
| **Missing Rate (MR)** | **2** | **0.55209227** | **0.27604614** | **1442.80** | **<.0001** | **0.1123\*** |
| Model Fitting (MF) | 1 | 0.02554660 | 0.02554660 | 133.52 | <.0001 | 0.0052 |
| A\*MR | 36 | 0.07148148 | 0.00198560 | 10.38 | <.0001 | 0.0145 |
| A\*MF | 18 | 0.04991311 | 0.00277295 | 14.49 | <.0001 | 0.0102 |
| MR\*MF | 2 | 0.00580532 | 0.00290266 | 15.17 | <.0001 | 0.0012 |
| Error | 36 | 0.00688777 | 0.00019133 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.30844157 | 0.01713564 | 33679.2 | <.0001 | 0.9401\* |
| Missing Rate (MR) | 2 | 0.01441465 | 0.00720732 | 14165.6 | <.0001 | 0.0439 |
| Model Fitting (MF) | 1 | 0.00003582 | 0.00003582 | 70.40 | <.0001 | 0.0001 |
| A\*MR | 36 | 0.00509395 | 0.00014150 | 278.11 | <.0001 | 0.0155 |
| A\*MF | 18 | 0.00007209 | 0.00000400 | 7.87 | <.0001 | 0.0002 |
| MR\*MF | 2 | 0.00001157 | 0.00000578 | 11.37 | 0.0001 | 0.0000 |
| Error | 36 | 0.00001832 | 0.00000051 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **16.54423564** | **0.91912420** | **123.54** | **<.0001** | **0.6011\*** |
| Missing Rate (MR) | 2 | 0.39925212 | 0.19962606 | 26.83 | <.0001 | 0.0145 |
| **Model Fitting (MF)** | **1** | **3.05994632** | **3.05994632** | **411.30** | **<.0001** | **0.1112\*** |
| A\*MR | 36 | 0.01750759 | 0.00048632 | 0.07 | 1.0000 | 0.0006 |
| **A\*MF** | **18** | **7.17189525** | **0.39843863** | **53.56** | **<.0001** | **0.2606\*** |
| MR\*MF | 2 | 0.06301111 | 0.03150555 | 4.23 | 0.0223 | 0.0023 |
| Error | 36 | 0.26783055 | 0.00743974 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **15.42736967** | **0.85707609** | **122.15** | **<.0001** | **0.6012\*** |
| Missing Rate (MR) | 2 | 0.38270063 | 0.19135032 | 27.27 | <.0001 | 0.0149 |
| **Model Fitting (MF)** | **1** | **2.93197725** | **2.93197725** | **417.86** | **<.0001** | **0.1143\*** |
| A\*MR | 36 | 0.01774380 | 0.00049288 | 0.07 | 1.0000 | 0.0007 |
| **A\*MF** | **18** | **6.58071548** | **0.36559530** | **52.10** | **<.0001** | **0.2564\*** |
| MR\*MF | 2 | 0.06946002 | 0.03473001 | 4.95 | 0.0126 | 0.0027 |
| Error | 36 | 0.25259830 | 0.00701662 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **18.47873613** | **1.02659645** | **126.55** | **<.0001** | **0.5957\*** |
| Missing Rate (MR) | 2 | 0.41532811 | 0.20766406 | 25.60 | <.0001 | 0.0134 |
| **Model Fitting (MF)** | **1** | **3.48231259** | **3.48231259** | **429.27** | **<.0001** | **0.1123\*** |
| A\*MR | 36 | 0.01658203 | 0.00046061 | 0.06 | 1.0000 | 0.0005 |
| **A\*MF** | **18** | **8.27147323** | **0.45952629** | **56.65** | **<.0001** | **0.2667\*** |
| MR\*MF | 2 | 0.06301872 | 0.03150936 | 3.88 | 0.0297 | 0.0020 |
| Error | 36 | 0.29203559 | 0.00811210 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

III. β1 = 0.1, β2 = 0.1, β3 = 1 paired with a short intervention phase (*n*A=10, *n*B=10)

a. RB

Figure. RB of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00152020 | 0.00008446 | 278.48 | <.0001 | 0.3277\* |
| Missing Rate (MR) | 2 | 0.00217022 | 0.00108511 | 3577.93 | <.0001 | 0.4678\* |
| Model Fitting (MF) | 1 | 0.00000197 | 0.00000197 | 6.48 | 0.0153 | 0.0004 |
| A\*MR | 36 | 0.00091139 | 0.00002532 | 83.48 | <.0001 | 0.1965\* |
| A\*MF | 18 | 0.00001201 | 0.00000067 | 2.20 | 0.0216 | 0.0026 |
| MR\*MF | 2 | 0.00001257 | 0.00000628 | 20.70 | <.0001 | 0.0027 |
| Error | 36 | 0.00001092 | 0.00000030 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RB of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase, divided by 10. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.04597076** | **0.00255393** | **43.65** | **<.0001** | **0.2157\*** |
| **Missing Rate (MR)** | **2** | **0.08379530** | **0.04189765** | **716.12** | **<.0001** | **0.3932\*** |
| Model Fitting (MF) | 1 | 0.00011300 | 0.00011300 | 1.93 | 0.1731 | 0.0005 |
| **A\*MR** | **36** | **0.07833806** | **0.00217606** | **37.19** | **<.0001** | **0.3676\*** |
| A\*MF | 18 | 0.00038482 | 0.00002138 | 0.37 | 0.9872 | 0.0018 |
| MR\*MF | 2 | 0.00240449 | 0.00120224 | 20.55 | <.0001 | 0.0113 |
| Error | 36 | 0.00210624 | 0.00005851 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RB of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00002716 | 0.00000151 | 319.11 | <.0001 | 0.3344\* |
| Missing Rate (MR) | 2 | 0.00003647 | 0.00001823 | 3857.15 | <.0001 | 0.4490\* |
| Model Fitting (MF) | 1 | 0.00000004 | 0.00000004 | 9.29 | 0.0043 | 0.0005 |
| A\*MR | 36 | 0.00001711 | 0.00000048 | 100.52 | <.0001 | 0.2106\* |
| A\*MF | 18 | 0.00000022 | 0.00000001 | 2.64 | 0.0064 | 0.0028 |
| MR\*MF | 2 | 0.00000004 | 0.00000002 | 4.63 | 0.0163 | 0.0005 |
| Error | 36 | 0.00000017 | 0.00000000 |  |  |  |

Note. Type I SS and Mean Square of missing rate, autocorrelation, and their interaction on relative bias for β3 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Therefore, the F values and p values of missing rate, autocorrelation, and their interaction on relative bias for β3 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

### b. RMSE

Figure. RMSE of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11739909 | 0.00652217 | 2224.94 | <.0001 | 0.9195\* |
| Missing Rate (MR) | 2 | 0.00726465 | 0.00363232 | 1239.12 | <.0001 | 0.0569\* |
| Model Fitting (MF) | 1 | 0.00018147 | 0.00018147 | 61.90 | <.0001 | 0.0014 |
| A\*MR | 36 | 0.00214168 | 0.00005949 | 20.29 | <.0001 | 0.0168 |
| A\*MF | 18 | 0.00053527 | 0.00002974 | 10.14 | <.0001 | 0.0042 |
| MR\*MF | 2 | 0.00004357 | 0.00002178 | 7.43 | 0.0020 | 0.0003 |
| Error | 36 | 0.00010553 | 0.00000293 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RMSEs are those above the bold reference line at RMSE = 1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **4.20368307** | **0.23353795** | **1220.69** | **<.0001** | **0.8552\*** |
| **Missing Rate (MR)** | **2** | **0.55209922** | **0.27604961** | **1442.89** | **<.0001** | **0.1123\*** |
| Model Fitting (MF) | 1 | 0.02554810 | 0.02554810 | 133.54 | <.0001 | 0.0052 |
| A\*MR | 36 | 0.07148194 | 0.00198561 | 10.38 | <.0001 | 0.0145 |
| A\*MF | 18 | 0.04991622 | 0.00277312 | 14.49 | <.0001 | 0.0102 |
| MR\*MF | 2 | 0.00580557 | 0.00290279 | 15.17 | <.0001 | 0.0012 |
| Error | 36 | 0.00688740 | 0.00019132 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RMSE of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.30843840 | 0.01713547 | 33641.8 | <.0001 | 0.9401\* |
| Missing Rate (MR) | 2 | 0.01441497 | 0.00720748 | 14150.4 | <.0001 | 0.0439 |
| Model Fitting (MF) | 1 | 0.00003584 | 0.00003584 | 70.36 | <.0001 | 0.0001 |
| A\*MR | 36 | 0.00509387 | 0.00014150 | 277.80 | <.0001 | 0.0155 |
| A\*MF | 18 | 0.00007210 | 0.00000401 | 7.86 | <.0001 | 0.0002 |
| MR\*MF | 2 | 0.00001156 | 0.00000578 | 11.35 | 0.0002 | 0.0000 |
| Error | 36 | 0.00001834 | 0.00000051 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **16.54423564** | **0.91912420** | **123.54** | **<.0001** | **0.6011\*** |
| Missing Rate (MR) | 2 | 0.39925212 | 0.19962606 | 26.83 | <.0001 | 0.0145 |
| **Model Fitting (MF)** | **1** | **3.05994632** | **3.05994632** | **411.30** | **<.0001** | **0.1112\*** |
| A\*MR | 36 | 0.01750759 | 0.00048632 | 0.07 | 1.0000 | 0.0006 |
| **A\*MF** | **18** | **7.17189525** | **0.39843863** | **53.56** | **<.0001** | **0.2606\*** |
| MR\*MF | 2 | 0.06301111 | 0.03150555 | 4.23 | 0.0223 | 0.0023 |
| Error | 36 | 0.26783055 | 0.00743974 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **15.42736967** | **0.85707609** | **122.15** | **<.0001** | **0.6012\*** |
| Missing Rate (MR) | 2 | 0.38270063 | 0.19135032 | 27.27 | <.0001 | 0.0149 |
| **Model Fitting (MF)** | **1** | **2.93197725** | **2.93197725** | **417.86** | **<.0001** | **0.1143\*** |
| A\*MR | 36 | 0.01774380 | 0.00049288 | 0.07 | 1.0000 | 0.0007 |
| **A\*MF** | **18** | **6.58071548** | **0.36559530** | **52.10** | **<.0001** | **0.2564\*** |
| MR\*MF | 2 | 0.06946002 | 0.03473001 | 4.95 | 0.0126 | 0.0027 |
| Error | 36 | 0.25259830 | 0.00701662 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **18.47873613** | **1.02659645** | **126.55** | **<.0001** | **0.5957\*** |
| Missing Rate (MR) | 2 | 0.41532811 | 0.20766406 | 25.60 | <.0001 | 0.0134 |
| **Model Fitting (MF)** | **1** | **3.48231259** | **3.48231259** | **429.27** | **<.0001** | **0.1123\*** |
| A\*MR | 36 | 0.01658203 | 0.00046061 | 0.06 | 1.0000 | 0.0005 |
| **A\*MF** | **18** | **8.27147323** | **0.45952629** | **56.65** | **<.0001** | **0.2667\*** |
| MR\*MF | 2 | 0.06301872 | 0.03150936 | 3.88 | 0.0297 | 0.0020 |
| Error | 36 | 0.29203559 | 0.00811210 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a short intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

IV. β1 = 1, β2 = 0.1, β3 = 0.1 paired with a long intervention phase (*n*A=10, *n*B=56)

a. RB

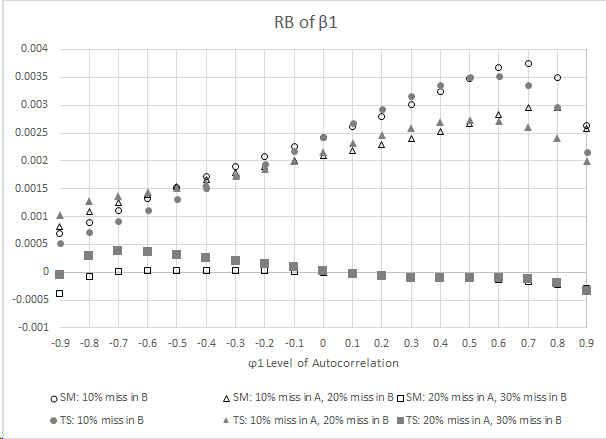


Figure. RB of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00002619 | 0.00000145 | 124.78 | <.0001 | 0.1546\* |
| Missing Rate (MR) | 2 | 0.00012066 | 0.00006033 | 5174.99 | <.0001 | 0.7124\* |
| Model Fitting (MF) | 1 | 0.00000001 | 0.00000001 | 0.45 | 0.5073 | 0.0000 |
| A\*MR | 36 | 0.00002123 | 0.00000059 | 50.58 | 0.00002123 | 0.1253\* |
| A\*MF | 18 | 0.00000058 | 0.00000003 | 2.74 | 0.0049 | 0.0034 |
| MR\*MF | 2 | 0.00000031 | 0.00000016 | 13.34 | <.0001 | 0.0018 |
| Error | 36 | 0.00000042 | 0.00000001 |  |  |  |

*Note*. Type I SS and Mean Square of missing proportion, autocorrelation, model fitting and their two-way interactions on relative bias for β1 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Therefore, the *F* values and *p* values of missing proportion, autocorrelation, model fitting and their two-way interactions on relative bias for β1 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

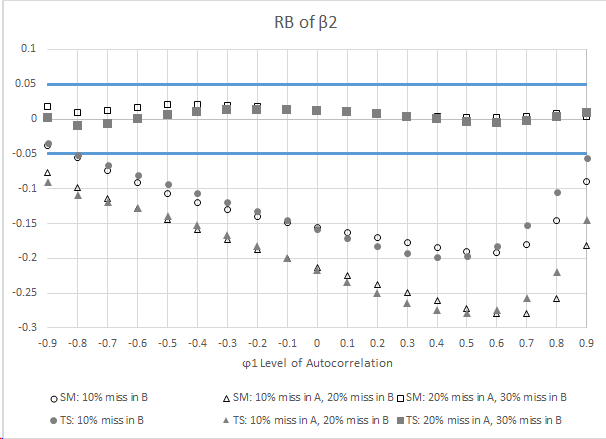


Figure. RB of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.15346966** | **0.00852609** | **180.35** | **<.0001** | **0.1454\*** |
| **Missing Rate (MR)** | **2** | **0.81700654** | **0.40850327** | **8640.96** | **<.0001** | **0.7743\*** |
| Model Fitting (MF) | 1 | 0.00001238 | 0.00001238 | 0.26 | 0.6120 | 0.0000 |
| **A\*MR** | **36** | **0.07883575** | **0.00218988** | **46.32** | **<.0001** | **0.0747\*** |
| A\*MF | 18 | 0.00308949 | 0.00017164 | 3.63 | 0.0005 | 0.0029 |
| MR\*MF | 2 | 0.00103077 | 0.00051538 | 10.90 | 0.0002 | 0.0010 |
| Error | 36 | 0.00170191 | 0.00004728 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

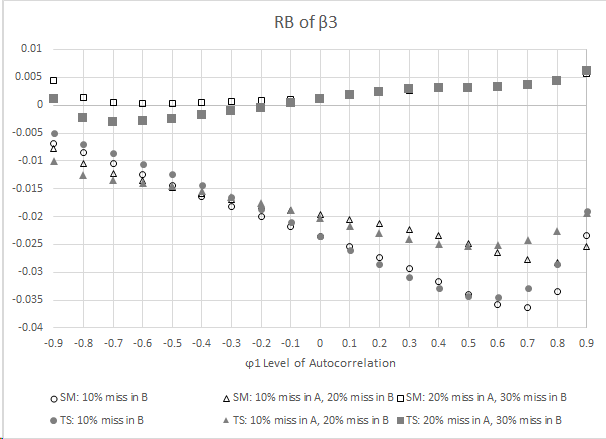


Figure. RB of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00215881 | 0.00011993 | 101.85 | <.0001 | 0.1254\* |
| Missing Rate (MR) | 2 | 0.01261156 | 0.00630578 | 5354.74 | <.0001 | 0.7323\* |
| Model Fitting (MF) | 1 | 0.00000048 | 0.00000048 | 0.41 | 0.5274 | 0.0000 |
| A\*MR | 36 | 0.00232050 | 0.00006446 | 54.74 | <.0001 | 0.1347\* |
| A\*MF | 18 | 0.00005763 | 0.00000320 | 2.72 | 0.0052 | 0.0033 |
| MR\*MF | 2 | 0.00002943 | 0.00001472 | 12.50 | <.0001 | 0.0017 |
| Error | 36 | 0.00004239 | 0.00000118 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### b. RMSE

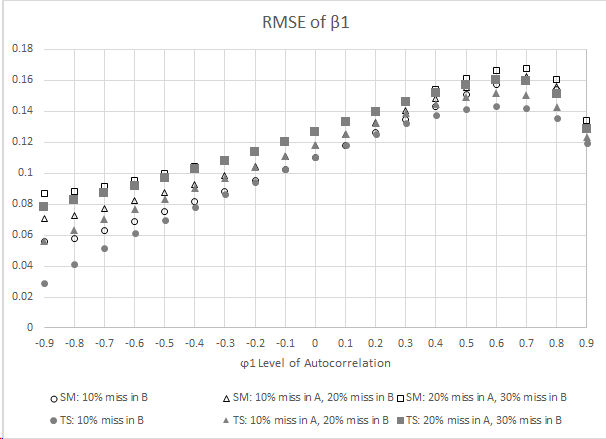


Figure. RMSE of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.10883691 | 0.00604649 | 2067.41 | <.0001 | 0.9118\* |
| Missing Rate (MR) | 2 | 0.00722470 | 0.00361235 | 1235.13 | <.0001 | 0.0605\* |
| Model Fitting (MF) | 1 | 0.00084701 | 0.00084701 | 289.61 | <.0001 | 0.0071 |
| A\*MR | 36 | 0.00152283 | 0.00004230 | 14.46 | <.0001 | 0.0128 |
| A\*MF | 18 | 0.00072484 | 0.00004027 | 13.77 | <.0001 | 0.0061 |
| MR\*MF | 2 | 0.00010091 | 0.00005046 | 17.25 | <.0001 | 0.0008 |
| Error | 36 | 0.00010529 | 0.00000292 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

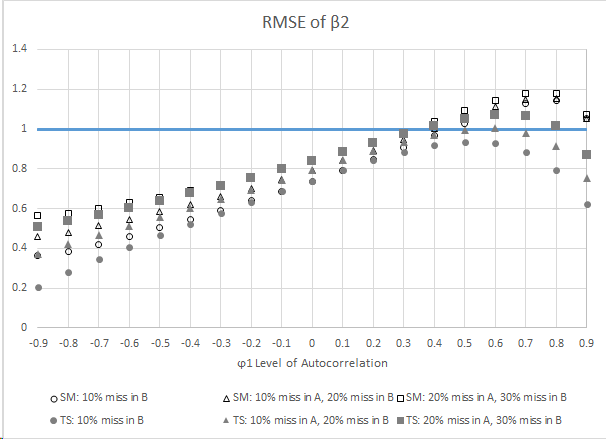


Figure. RMSE of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RMSEs are those above the bold reference line at RMSE = 1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **5.24900250** | **0.29161125** | **513.78** | **<.0001** | **0.8728\*** |
| **Missing Rate (MR)** | **2** | **0.34606311** | **0.17303156** | **304.86** | **<.0001** | **0.0575\*** |
| Model Fitting (MF) | 1 | 0.13008273 | 0.13008273 | 229.19 | <.0001 | 0.0216 |
| A\*MR | 36 | 0.04319355 | 0.00119982 | 2.11 | 0.0137 | 0.0072 |
| A\*MF | 18 | 0.21160336 | 0.01175574 | 20.71 | <.0001 | 0.0352 |
| MR\*MF | 2 | 0.01335491 | 0.00667746 | 11.76 | 0.0001 | 0.0022 |
| Error | 36 | 0.02043303 | 0.00056758 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

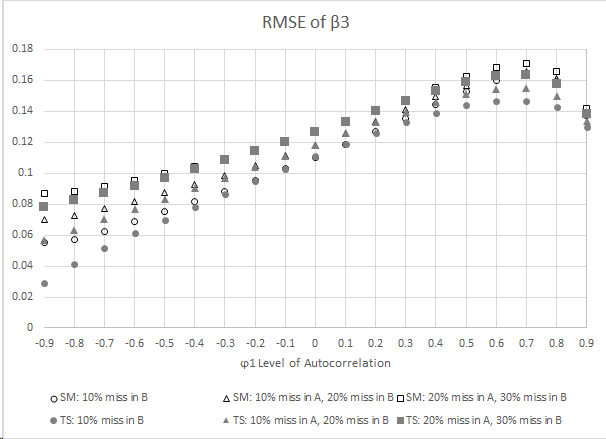


Figure. RMSE of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11850386 | 0.00658355 | 2454.69 | <.0001 | 0.9203\* |
| Missing Rate (MR) | 2 | 0.00715391 | 0.00357696 | 1333.68 | <.0001 | 0.0556\* |
| Model Fitting (MF) | 1 | 0.00071535 | 0.00071535 | 266.72 | <.0001 | 0.0056 |
| A\*MR | 36 | 0.00158913 | 0.00004414 | 16.46 | <.0001 | 0.0123 |
| A\*MF | 18 | 0.00062216 | 0.00003456 | 12.89 | <.0001 | 0.0048 |
| MR\*MF | 2 | 0.00008903 | 0.00004451 | 16.60 | <.0001 | 0.0007 |
| Error | 36 | 0.00009655 | 0.00000268 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **19.79443331** | **1.09969074** | **147.64** | **<.0001** | **0.6519\*** |
| Missing Rate (MR) | 2 | 0.26118694 | 0.13059347 | 17.53 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.75048333** | **1.75048333** | **235.01** | **<.0001** | **0.0577\*** |
| A\*MR | 36 | 0.01345892 | 0.00037386 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.21458209** | **0.45636567** | **61.27** | **<.0001** | **0.2706\*** |
| MR\*MF | 2 | 0.06012381 | 0.03006191 | 4.04 | 0.0262 | 0.0020 |
| Error | 36 | 0.26814691 | 0.00744853 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.03140524** | **1.11285585** | **149.54** | **<.0001** | **0.6380\*** |
| Missing Rate (MR) | 2 | 0.24679503 | 0.12339751 | 16.58 | <.0001 | 0.0079 |
| **Model Fitting (MF)** | **1** | **2.04679829** | **2.04679829** | **275.03** | **<.0001** | **0.0652\*** |
| A\*MR | 36 | 0.01359060 | 0.00037752 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.70921589** | **0.48384533** | **65.01** | **<.0001** | **0.2774\*** |
| MR\*MF | 2 | 0.08039763 | 0.04019881 | 5.40 | 0.0089 | 0.0026 |
| Error | 36 | 0.26791452 | 0.00744207 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β1 =1 and β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.18989032** | **1.12166057** | **147.72** | **<.0001** | **0.6535\*** |
| Missing Rate (MR) | 2 | 0.26440007 | 0.13220004 | 17.41 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.73754304** | **1.73754304** | **228.83** | **<.0001** | **0.0562\*** |
| A\*MR | 36 | 0.01357025 | 0.00037695 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.35692344** | **0.46427352** | **61.14** | **<.0001** | **0.2705\*** |
| MR\*MF | 2 | 0.05741628 | 0.02870814 | 3.78 | 0.0323 | 0.0019 |
| Error | 36 | 0.27335607 | 0.00759322 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

V. β1 = 0.1, β2 = 1, β3 = 0.1 paired with a long intervention phase (*n*A=10, *n*B=56)

a. RB

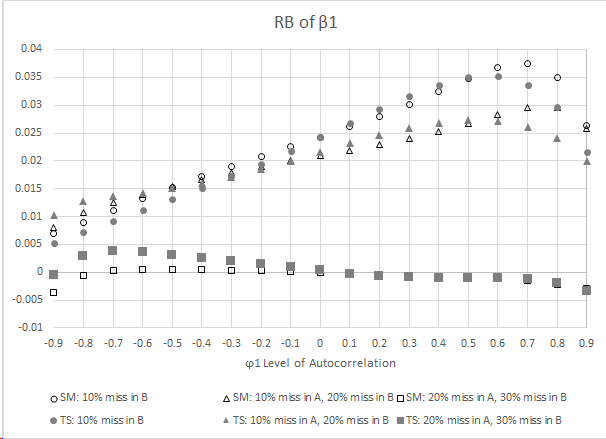


Figure. RB of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00261889 | 0.00014549 | 124.82 | <.0001 | 0.1551\* |
| Missing Rate (MR) | 2 | 0.01201120 | 0.00600560 | 5152.21 | <.0001 | 0.7115\* |
| Model Fitting (MF) | 1 | 0.00000055 | 0.00000055 | 0.47 | 0.4963 | 0.0000 |
| A\*MR | 36 | 0.00212107 | 0.00005892 | 50.55 | <.0001 | 0.1256\* |
| A\*MF | 18 | 0.00005757 | 0.00000320 | 2.74 | 0.0049 | 0.0034 |
| MR\*MF | 2 | 0.00003100 | 0.00001550 | 13.30 | <.0001 | 0.0018 |
| Error | 36 | 0.00004196 | 0.00000117 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

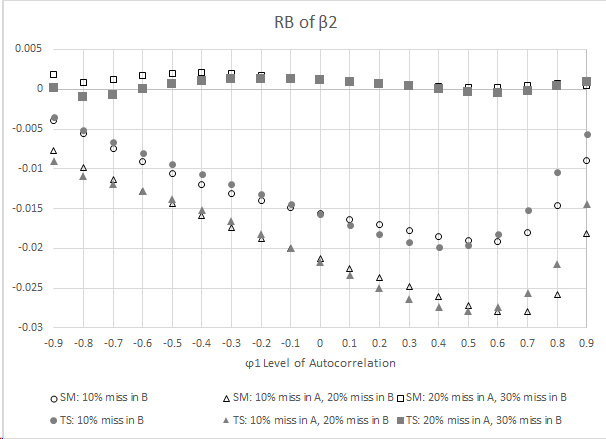


Figure. RB of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00153298 | 0.00008517 | 180.11 | <.0001 | 0.1455\* |
| Missing Rate (MR) | 2 | 0.00815756 | 0.00407878 | 8625.74 | <.0001 | 0.7742\* |
| Model Fitting (MF) | 1 | 0.00000014 | 0.00000014 | 0.30 | 0.5895 | 0.0000 |
| A\*MR | 36 | 0.00078795 | 0.00002189 | 46.29 | <.0001 | 0.0748\* |
| A\*MF | 18 | 0.00003125 | 0.00000174 | 3.67 | 0.0004 | 0.0030 |
| MR\*MF | 2 | 0.00001023 | 0.00000511 | 10.82 | 0.0002 | 0.0010 |
| Error | 36 | 0.00001702 | 0.00000047 |  |  |  |

Note. Type I SS and Mean Square of missing rate, autocorrelation, and their interaction on relative bias for β2 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Therefore, the F values and p values of missing rate, autocorrelation, and their interaction on relative bias for β3 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06



Figure. RB of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00215918 | 0.00011995 | 101.86 | <.0001 | 0.1256\* |
| Missing Rate (MR) | 2 | 0.01257850 | 0.00628925 | 5340.78 | <.0001 | 0.7319\* |
| Model Fitting (MF) | 1 | 0.00000051 | 0.00000051 | 0.43 | 0.5167 | 0.0000 |
| A\*MR | 36 | 0.00231867 | 0.00006441 | 54.69 | <.0001 | 0.1349\* |
| A\*MF | 18 | 0.00005762 | 0.00000320 | 2.72 | 0.0052 | 0.0034 |
| MR\*MF | 2 | 0.00002932 | 0.00001466 | 12.45 | <.0001 | 0.0017 |
| Error | 36 | 0.00004239 | 0.00000118 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### b. RMSE

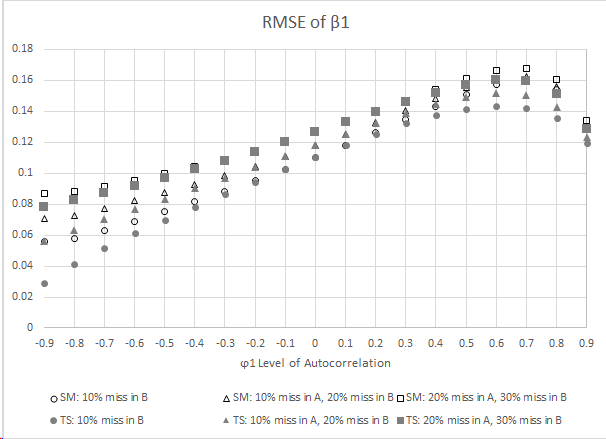


Figure. RMSE of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.10883740 | 0.00604652 | 2067.32 | <.0001 | 0.9118\* |
| Missing Rate (MR) | 2 | 0.00722509 | 0.00361254 | 1235.13 | <.0001 | 0.0605\* |
| Model Fitting (MF) | 1 | 0.00084696 | 0.00084696 | 289.58 | <.0001 | 0.0071 |
| A\*MR | 36 | 0.00152281 | 0.00004230 | 14.46 | <.0001 | 0.0128 |
| A\*MF | 18 | 0.00072481 | 0.00004027 | 13.77 | <.0001 | 0.0061 |
| MR\*MF | 2 | 0.00010092 | 0.00005046 | 17.25 | <.0001 | 0.0008 |
| Error | 36 | 0.00010529 | 0.00000292 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

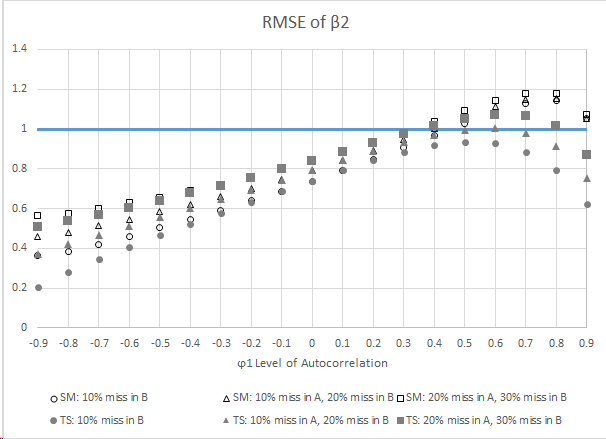


Figure. RMSE of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RMSEs are those above the bold reference line at RMSE = 1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **5.24889150** | **0.29160508** | **513.77** | **<.0001** | **0.8728\*** |
| **Missing Rate (MR)** | **2** | **0.34611087** | **0.17305543** | **304.90** | **<.0001** | **0.0576\*** |
| Model Fitting (MF) | 1 | 0.13008543 | 0.13008543 | 229.19 | <.0001 | 0.0216 |
| A\*MR | 36 | 0.04320057 | 0.00120002 | 2.11 | 0.0137 | 0.0072 |
| A\*MF | 18 | 0.21160641 | 0.01175591 | 20.71 | <.0001 | 0.0352 |
| MR\*MF | 2 | 0.01335435 | 0.00667718 | 11.76 | 0.0001 | 0.0022 |
| Error | 36 | 0.02043274 | 0.00056758 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

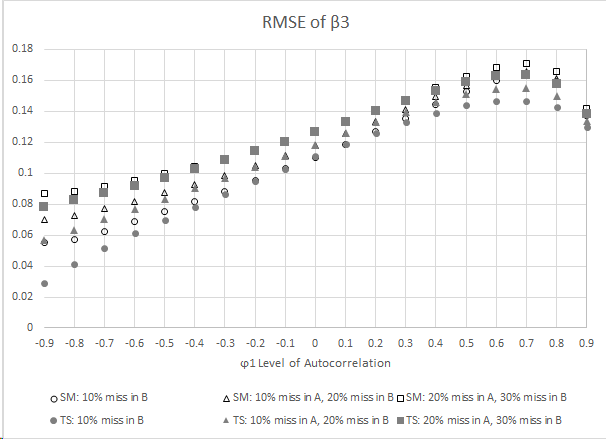


Figure. RMSE of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11850198 | 0.00658344 | 2453.97 | <.0001 | 0.9203\* |
| Missing Rate (MR) | 2 | 0.00715450 | 0.00357725 | 1333.42 | <.0001 | 0.0556\* |
| Model Fitting (MF) | 1 | 0.00071530 | 0.00071530 | 266.63 | <.0001 | 0.0056 |
| A\*MR | 36 | 0.00158943 | 0.00004415 | 16.46 | <.0001 | 0.0123 |
| A\*MF | 18 | 0.00062213 | 0.00003456 | 12.88 | <.0001 | 0.0048 |
| MR\*MF | 2 | 0.00008905 | 0.00004452 | 16.60 | <.0001 | 0.0007 |
| Error | 36 | 0.00009658 | 0.00000268 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **19.79439980** | **1.09968888** | **147.64** | **<.0001** | **0.6519\*** |
| Missing Rate (MR) | 2 | 0.26118792 | 0.13059396 | 17.53 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.75048581** | **1.75048581** | **235.01** | **<.0001** | **0.0577\*** |
| A\*MR | 36 | 0.01345881 | 0.00037386 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.21460335** | **0.45636685** | **61.27** | **<.0001** | **0.2706\*** |
| MR\*MF | 2 | 0.06012317 | 0.03006158 | 4.04 | 0.0262 | 0.0020 |
| Error | 36 | 0.26814757 | 0.00744854 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.03139940** | **1.11285552** | **149.54** | **<.0001** | **0.6380\*** |
| Missing Rate (MR) | 2 | 0.24679612 | 0.12339806 | 16.58 | <.0001 | 0.0079 |
| **Model Fitting (MF)** | **1** | **2.04679561** | **2.04679561** | **275.03** | **<.0001** | **0.0652\*** |
| A\*MR | 36 | 0.01359083 | 0.00037752 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.70921942** | **0.48384552** | **65.01** | **<.0001** | **0.2774\*** |
| MR\*MF | 2 | 0.08039696 | 0.04019848 | 5.40 | 0.0089 | 0.0026 |
| Error | 36 | 0.26791540 | 0.00744209 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β2 =1 and β1 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.18989032** | **1.12166057** | **147.72** | **<.0001** | **0.6535\*** |
| Missing Rate (MR) | 2 | 0.26440007 | 0.13220004 | 17.41 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.73754304** | **1.73754304** | **228.83** | **<.0001** | **0.0562\*** |
| A\*MR | 36 | 0.01357025 | 0.00037695 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.35692344** | **0.46427352** | **61.14** | **<.0001** | **0.2705\*** |
| MR\*MF | 2 | 0.05741628 | 0.02870814 | 3.78 | 0.0323 | 0.0019 |
| Error | 36 | 0.27335607 | 0.00759322 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

VI. β1 = 0.1, β2 = 0.1, β3 = 1 paired with a long intervention phase (*n*A=10, *n*B=56)

a. RB

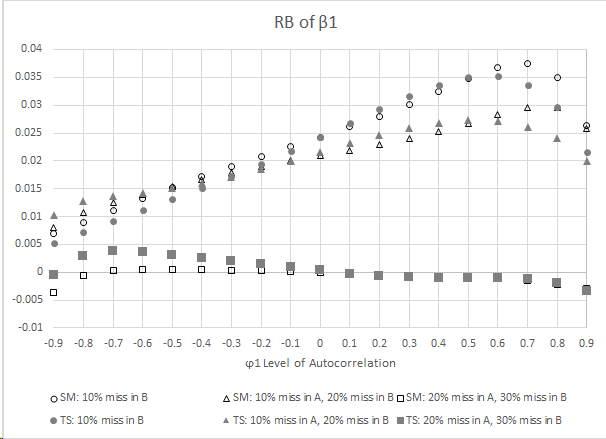


Figure. RB of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00261853 | 0.00014547 | 124.62 | <.0001 | 0.1551\* |
| Missing Rate (MR) | 2 | 0.01200853 | 0.00600426 | 5143.52 | <.0001 | 0.7114\* |
| Model Fitting (MF) | 1 | 0.00000052 | 0.00000052 | 0.45 | 0.5068 | 0.0000 |
| A\*MR | 36 | 0.00212154 | 0.00005893 | 50.48 | <.0001 | 0.1257\* |
| A\*MF | 18 | 0.00005747 | 0.00000319 | 2.73 | 0.0050 | 0.0034 |
| MR\*MF | 2 | 0.00003111 | 0.00001555 | 13.33 | <.0001 | 0.0018 |
| Error | 36 | 0.00004202 | 0.00000117 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

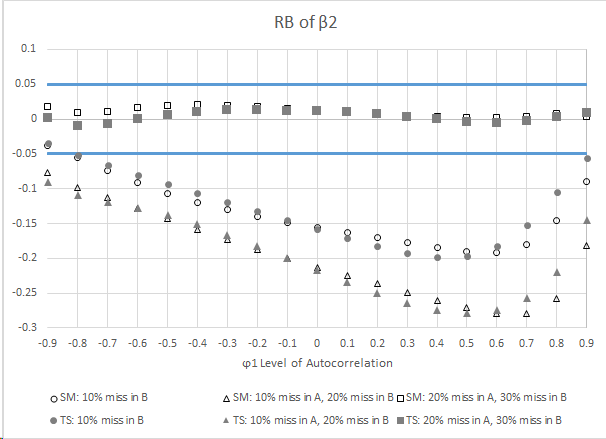


Figure. RB of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **0.15343429** | **0.00852413** | **180.02** | **<.0001** | **0.1457\*** |
| **Missing Rate (MR)** | **2** | **0.81473276** | **0.40736638** | **8603.23** | **<.0001** | **0.7738\*** |
| Model Fitting (MF) | 1 | 0.00001243 | 0.00001243 | 0.26 | 0.6115 | 0.0000 |
| **A\*MR** | **36** | **0.07883390** | **0.00218983** | **46.25** | **<.0001** | **0.0749\*** |
| A\*MF | 18 | 0.00308764 | 0.00017154 | 3.62 | 0.0005 | 0.0029 |
| MR\*MF | 2 | 0.00103017 | 0.00051509 | 10.88 | 0.0002 | 0.0010 |
| Error | 36 | 0.00170461 | 0.00004735 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

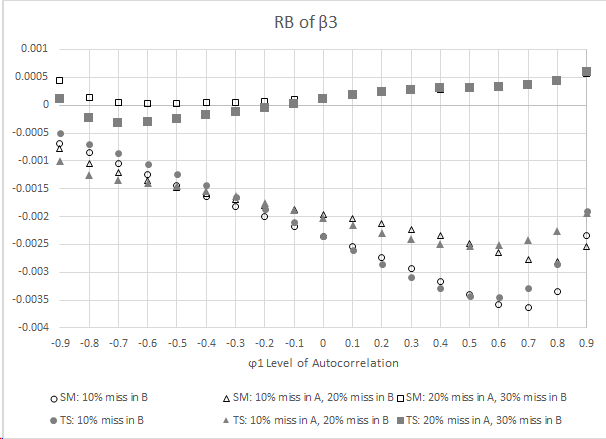


Figure. RB of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase, divided by 10. All the RBs were acceptable (|RB|< 0.05).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on relative bias for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.00002159 | 0.00000120 | 101.68 | <.0001 | 0.1258\* |
| Missing Rate (MR) | 2 | 0.00012554 | 0.00006277 | 5321.80 | <.0001 | 0.7315\* |
| Model Fitting (MF) | 1 | 0.00000000 | 0.00000000 | 0.41 | 0.5268 | 0.0000 |
| A\*MR | 36 | 0.00002319 | 0.00000064 | 54.62 | <.0001 | 0.1351\* |
| A\*MF | 18 | 0.00000058 | 0.00000003 | 2.71 | 0.0053 | 0.0034 |
| MR\*MF | 2 | 0.00000029 | 0.00000015 | 12.47 | <.0001 | 0.0017 |
| Error | 36 | 0.00000042 | 0.00000001 |  |  |  |

Note. Type I SS and Mean Square of missing proportion, autocorrelation, and their interaction on relative bias for β3 were 1/100 times of the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Therefore, the F values and p values of missing proportion, autocorrelation, and their interaction on relative bias for β3 were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### b. RMSE

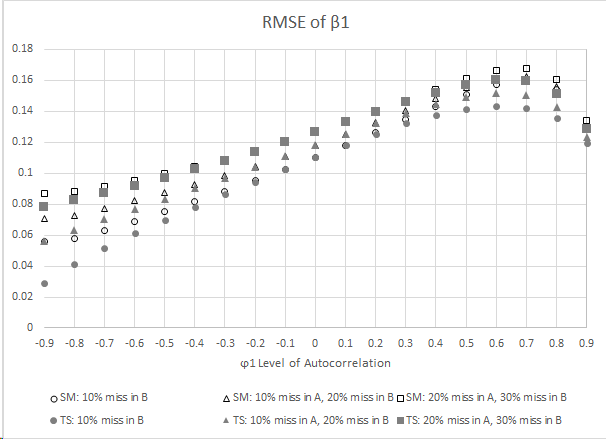


Figure. RMSE of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.10883685 | 0.00604649 | 2066.88 | <.0001 | 0.9118\* |
| Missing Rate (MR) | 2 | 0.00722528 | 0.00361264 | 1234.92 | <.0001 | 0.0605\* |
| Model Fitting (MF) | 1 | 0.00084707 | 0.00084707 | 289.55 | <.0001 | 0.0071 |
| A\*MR | 36 | 0.00152277 | 0.00004230 | 14.46 | <.0001 | 0.0128 |
| A\*MF | 18 | 0.00072476 | 0.00004026 | 13.76 | <.0001 | 0.0061 |
| MR\*MF | 2 | 0.00010089 | 0.00005045 | 17.24 | <.0001 | 0.0008 |
| Error | 36 | 0.00010531 | 0.00000293 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

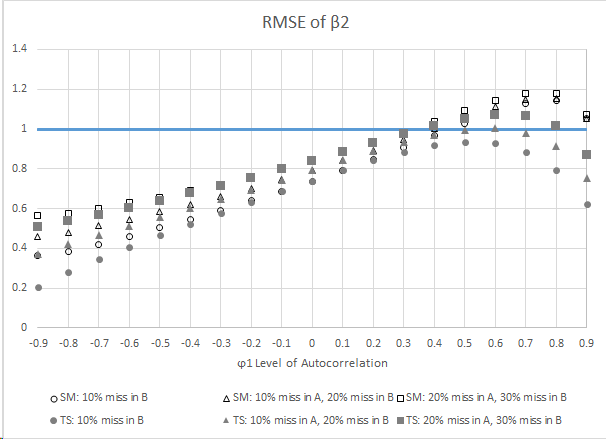


Figure. RMSE of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **5.24893750** | **0.29160764** | **513.79** | **<.0001** | **0.8728\*** |
| **Missing Rate (MR)** | **2** | **0.34612306** | **0.17306153** | **304.92** | **<.0001** | **0.0576\*** |
| Model Fitting (MF) | 1 | 0.13008475 | 0.13008475 | 229.20 | <.0001 | 0.0216 |
| A\*MR | 36 | 0.04319902 | 0.00119997 | 2.11 | 0.0137 | 0.0072 |
| A\*MF | 18 | 0.21160490 | 0.01175583 | 20.71 | <.0001 | 0.0352 |
| MR\*MF | 2 | 0.01335460 | 0.00667730 | 11.76 | 0.0001 | 0.0022 |
| Error | 36 | 0.02043205 | 0.00056756 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

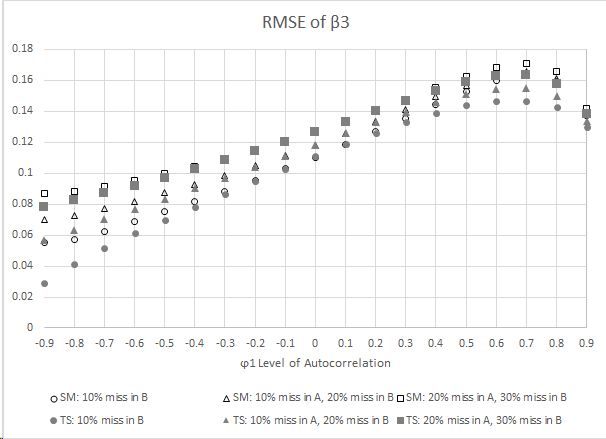


Figure. RMSE of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. All the RMSEs were acceptable (RMSE< 1).

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RMSE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| Autocorrelation (A) | 18 | 0.11850274 | 0.00658349 | 2453.89 | <.0001 | 0.9203\* |
| Missing Rate (MR) | 2 | 0.00715469 | 0.00357735 | 1333.40 | <.0001 | 0.0556\* |
| Model Fitting (MF) | 1 | 0.00071525 | 0.00071525 | 266.60 | <.0001 | 0.0056 |
| A\*MR | 36 | 0.00158936 | 0.00004415 | 16.46 | <.0001 | 0.0123 |
| A\*MF | 18 | 0.00062212 | 0.00003456 | 12.88 | <.0001 | 0.0048 |
| MR\*MF | 2 | 0.00008907 | 0.00004453 | 16.60 | <.0001 | 0.0007 |
| Error | 36 | 0.00009658 | 0.00000268 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase.

\**p* < .05 and η2 ≥ .06

### c. RBESE

Figure. RBESE of β1, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **19.79446021** | **1.09969223** | **147.64** | **<.0001** | **0.6519\*** |
| Missing Rate (MR) | 2 | 0.26118573 | 0.13059286 | 17.53 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.75048086** | **1.75048086** | **235.01** | **<.0001** | **0.0577\*** |
| A\*MR | 36 | 0.01345964 | 0.00037388 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.21456545** | **0.45636475** | **61.27** | **<.0001** | **0.2706\*** |
| MR\*MF | 2 | 0.06012436 | 0.03006218 | 4.04 | 0.0262 | 0.0020 |
| Error | 36 | 0.26815065 | 0.00744863 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β2, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.03143291** | **1.11285738** | **149.54** | **<.0001** | **0.6380\*** |
| Missing Rate (MR) | 2 | 0.24679393 | 0.12339697 | 16.58 | <.0001 | 0.0079 |
| **Model Fitting (MF)** | **1** | **2.04679293** | **2.04679293** | **275.03** | **<.0001** | **0.0652\*** |
| A\*MR | 36 | 0.01359086 | 0.00037752 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.70919792** | **0.48384433** | **65.01** | **<.0001** | **0.2774\*** |
| MR\*MF | 2 | 0.08039830 | 0.04019915 | 5.40 | 0.0089 | 0.0026 |
| Error | 36 | 0.26791474 | 0.00744208 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

Figure. RBESE of β3, with β3 =1 and β1 = β2 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model and TS stands for the time-series model. Results were the same as the results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or above the bold reference line at RBESE = 0.1.

Table. ANOVA results of the impact of missing rate, autocorrelation, model fitting, and their interactions on RBESE for β3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | DF | Type I SS | Mean Square | F | Pr > F | η2 |
| **Autocorrelation (A)** | **18** | **20.18989032** | **1.12166057** | **147.72** | **<.0001** | **0.6535\*** |
| Missing Rate (MR) | 2 | 0.26440007 | 0.13220004 | 17.41 | <.0001 | 0.0086 |
| **Model Fitting (MF)** | **1** | **1.73754304** | **1.73754304** | **228.83** | **<.0001** | **0.0562\*** |
| A\*MR | 36 | 0.01357025 | 0.00037695 | 0.05 | 1.0000 | 0.0004 |
| **A\*MF** | **18** | **8.35692344** | **0.46427352** | **61.14** | **<.0001** | **0.2705\*** |
| MR\*MF | 2 | 0.05741628 | 0.02870814 | 3.78 | 0.0323 | 0.0019 |
| Error | 36 | 0.27335607 | 0.00759322 |  |  |  |

*Note*. Results were the same as results obtained from β1 = β2 = β3 = 0.1 paired with a long intervention phase. Boldface denotes unacceptable estimates under some manipulated conditions even though the ANOVA test result was significant.

\**p* < .05 and η2 ≥ .06

6. Mathematical proof of the impact on bias due to changes in βs

Assuming there is only one to be estimated:

Let be the new estimated *Y* when and *C* = 0.9

(becuase )

Least squared estimation:

Minimum when

7. Results obtained from using an alternative approach for fitting the simplified model

I. Figures obtained from β1 = β2 = β3 = 0.1, paired with a short intervention phase (*n*A =10, *n*B=10)

a. RB

Figure. RB of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05

b. RMSE

Figure. RMSE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

II. Figures obtained from β1 = β2 = β3 = 0.1, paired with a long intervention phase (*n*A = 10, *n*B = 56)

a. RB

Figure. RB of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05

b. RMSE

Figure. RMSE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 = β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

III. Figures obtained from β1 = 1; β2 = β3 = 0.1, paired with a short intervention phase (*n*A = 10, *n*B = 10)

a. RB

Figure. RB of β1, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05

b. RMSE

Figure. RMSE of β1, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

IV. Figures obtained from β1 = 1, β2 = β3 = 0.1, paired with a long intervention phase (*n*A = 10, *n*B = 56)

a. RB

Figure. RB of β1, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05

b. RMSE

Figure. RMSE of β1, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = 1; β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =1, β2 = β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

V. Figures obtained from β1 = 0.1, β2 =1, β3 = 0.1, paired with a short intervention phase (*n*A = 10, *n*B = 10)

a. RB

Figure. RB of β1, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

b. RMSE

Figure. RMSE of β1, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

VI. Figures obtained from β1 = 0.1, β2 =1, β3 = 0.1, paired with a long intervention phase (*n*A = 10, *n*B = 56)

a. RB

Figure. RB of β1, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

b. RMSE

Figure. RMSE of β1, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = 0.1, β2 =1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =0.1, β2 = 1, β3 = 0.1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

VII. Figures obtained from β1 = β2 =0.1, β3 = 1, paired with a short intervention phase (*n*A = 10, *n*B = 10)

a. RB

Figure. RB of β1, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

b. RMSE

Figure. RMSE of β1, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 10). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

VIII. Figures obtained from β1 = β2 =0.1, β3 = 1, paired with a long intervention phase (*n*A = 10, *n*B = 56)

a. RB

Figure. RB of β1, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

Figure. RB of β2, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBs are those below the bold reference line at RB = − 0.05 or above the bold reference line at RB = 0.05.

Figure. RB of β3, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RBs were acceptable (|RB|< 0.05).

b. RMSE

Figure. RMSE of β1, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

Figure. RMSE of β2, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RMSEs are represented by the circles, triangles, and squares above the bold reference line.

Figure. RMSE of β3, with β1 = β2 =0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. All the RMSEs were acceptable (RMSE< 1).

c. RBESE

Figure. RBESE of β1, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β2, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.

Figure. RBESE of β3, with β1 =0.1, β2 = 0.1, β3 = 1 (*n*A = 10, *n*B = 56). SM stands for the simplified model using replaced the missing data with EM and SMCOV stands for the simplified model using variance/covariance matrix with EM. Unacceptable RBESEs are those below the bold reference line at RBESE = − 0.1 or those above the bold reference line at RBESE = 0.1.