\*Calculation for linear Regression using SAS ;

/\* simple linear regression \*/

/\* Sample size 130 \*/

LIBNAME GBD "D:\Consulation";

**PROC** **IMPORT** OUT= GBD.Data

DATAFILE = "D:\Consulation\GBD\Data.sav"

DBMS=SPSS REPLACE;

**RUN**;

ODS RTF FILE = "D:\Consulation\GBD\Multiple Linear regression.RTF";

**PROC** **REG** DATA = GBD.Data ;

model JMEStunting2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /clb alpha=**0.05**;

output out = t student=res cookd = cookd h = lev;

**run**;

**quit**;

**data** t; set t;

resid\_sq = res\*res;

**run**;

**proc** **sgplot** data = t;

scatter y = lev x = resid\_sq / datalabel = S\_No;

**run**;

**quit**;

**proc** **print** data = t;

where cookd > **4**/**130**;

var S\_No Region Country\_

JMEStunting2022 Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts

cookd;

**run**;

**data** t2; set t;

rabs = abs(res);

**run**;

**proc** **sort** data = t2;

by descending rabs;

**run**;

**proc** **print** data = t2 (obs=**15**);

**run**;

ODS RTF CLOSE;

\*-------------------------- Robust Regression -------------------;

\* M: M-estimation, balances robustness and efficiency.

\* MM: High efficiency and robust to outliers.

\* S: Highly robust but computationally intensive.

\* LTS: Least Trimmed Squares, focuses on minimizing the effect of outliers.;

/\* https://support.sas.com/resources/papers/proceedings/proceedings/sugi27/p265-27.pdf \*/

ODS RTF FILE = "D:\Consulation\GBD\Robust Regression for stunting with all estimation procedures - 9 Dec 2024.RTF";

\* Title : Method M estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = M seed=**9122024**;

model JMEStunting2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**RUN**;

\* Title : Method MM estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = MM seed=**9122024**;

model JMEStunting2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**Run**;

\* Title : Method S estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = S ;

model JMEStunting2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**Run**;

\* Title : Method LTS estimation;

\* h = [ n[1-0.5] + p ]; p = number of variables;

\* fwls : Final Weighted Least Squares;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS(h=**85**) fwls;

model JMEStunting2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts / diagnostics leverage ;

**RUN**;

ODS RTF CLOSE;

ODS RTF FILE = "D:\Consulation\GBD\Robust Regression for wasting with all estimation procedures - 9 Dec 2024.RTF";

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = M ;

model JMEWastingJME2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**RUN**;

\* Title : Method MM estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = MM ;

model JMEWastingJME2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**Run**;

\* Title : Method S estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = S ;

model JMEWastingJME2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts /diagnostics leverage;

**Run**;

\* Title : Method LTS estimation;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS(h=**85**) fwls;

model JMEWastingJME2022 = Unsafewater Unsafesanitation UHC2021 SDI2021 HAQindex2021 Malaria Nematode Diarrhoea HIV2021 TB Noncerealplantprotein

TotalanimalProteingmcapitaday Totalkcalpdayavail Wheatandproducts Riceandproducts Maizeandproducts Milletandproducts Sorghumandproducts

Cassavaandproducts / diagnostics leverage;

**RUN**;

ODS RTF CLOSE;

\*------------------------------ ------------------------------------------;

ODS RTF FILE = "D:\Consulation\GBD\Univariate final RR for stunting - 14 Dec 2024.RTF";

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Unsafewater ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Unsafesanitation ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = UHC2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = SDI2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = HAQindex2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Malaria ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Nematode ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Diarrhoea ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = HIV2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = TB ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Noncerealplantprotein ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = TotalanimalProteingmcapitaday ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Totalkcalpdayavail ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Wheatandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Riceandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Maizeandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Milletandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Sorghumandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunting2022 = Cassavaandproducts ;

**RUN**;

ods rtf close;

ODS RTF FILE = "D:\Consulation\GBD\Univariate final RR for wasting - 14 Dec 2024.RTF";

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Unsafewater ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Unsafesanitation ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = UHC2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = SDI2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = HAQindex2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Malaria ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Nematode ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEStunJMEWastingJME2022ting2022 = Diarrhoea ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = HIV2021 ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = TB ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Noncerealplantprotein ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = TotalanimalProteingmcapitaday ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Totalkcalpdayavail ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Wheatandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Riceandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Maizeandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Milletandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Sorghumandproducts ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS fwls;

model JMEWastingJME2022 = Cassavaandproducts ;

**RUN**;

ods rtf close;

\*Robust Regression;

ODS RTF FILE = "D:\Consulation\GBD\RR for stunt and waste - 24 Dec 2024.RTF";

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS(h=**83**) fwls;

model JMEStunting2022 = zUHC zSDI zmal zdia ztb ztotanipro ztotcalday zwheat zrice zmaize zmilt zsorgam zcasava / diagnostics leverage ;

**RUN**;

**PROC** **ROBUSTREG** DATA = GBD.Data METHOD = LTS(h=**83**) fwls;

model JMEWastingJME2022 = zUHC zSDI zmal zdia ztb ztotanipro ztotcalday zwheat zrice zmaize zmilt zsorgam zcasava / diagnostics leverage ;

**RUN**;

ODS RTF CLOSE;