Details for some scripts of the repository for "Bayesian estimation of a multivariate TAR model when the noise process distribution belongs to the class of Gaussian variance mixtures"

For the M1 structure, that is a 3-variate 2 regimes MTAR model

Script for Resume simulations The script named `Resumen_Replicas_Student.R` can be used to obtain the results of table 10 and student-t columns of tables 1,2,5 and 9 for M1 structure model, which are printed in the R console. This script is divided into 5 parts. We also highly recommend to use `source(Resumen_Replicas_Student.R)` in order to get only the results in the console. In the first part, we load the file which contains the results of the simulations. In this case, we use the file named `replicas_Identify_Dist_RelativeBias_Forecasting_1000_2reg_ForStudent_1.rds` in line 13, in order to get the results for Student-t distribution error. In line 42 the object **para.extra** is set in `TRUE` due to Student-t distribution has a extra parameter. In case that distribution does not require extra parameter, you must change to `FALSE`.

Part 2 prints the results for percentage of times that true parameters lies in the credible intervals, and the relative bias for any parameters for tables 1 and 2, column 2(student-t). Part 3 prints the results of the forecasting of the table 5, column 2(student-t). In order to get the results in table 10, we use part 4, you must to be careful to uncomment and comment the right code line from lines 335 to 341. For instance, if you want to get the results for Gaussian distribution error, which correspond to column 1(Gaussian) of table 10, you must comment line 335 and uncomment line 336. By default, it is uncommented for laplace distribution. How the table 10 corresponds for results when the TRUE distribution error is student-t with 3 degrees of freedom, in order to get relative bias for this distribution you must uncomment line 341 not the 340. Only one line must be uncommented. Additionally, you must change the line 343 according if distribution selected above has or not extra parameter. Finally, part 5 give you the results for table 9 structure M1 column 2(student-t).

Of course, if you need obtain other results for other columns in tables 1,2, 5,9, and any other tables in the appendix online, you need to run the script explained in the following section(*Script for running simulations*). However, results may vary due the seeds were not controlled.

Script for running simulations The script named `IJFSimulChequeoDistribution2regbaseFinalParalelizar.R` is used to simulate, get the estimation of the parameters, obtain the h.ahead forecasting and store the results for the number of replications set. This script depends on function in `script summarymtar_simulation.R`, therefore this must be run before running this script.

What is stored? For each replication of the MTAR model simulated, it is stored mainly the estimation of the parameters including the credible intervals and the prediction intervals for each forecast horizon with its respective prediction interval for TRUE distribution error. Additionally, it is stored the estimations of parameters when other alternative distribution is postulated.

What can you modify in the code to explore all distributions for errors? Initially, you can modify the distribution error(for instance, you can use: "Gaussian", "Student-t", "Hyperbolic", "Laplace", "Slash", "Contaminated normal") and the extra parameter (check lines 71 and 74). The number of replications is controlled by object "*n_rep*"(see line 15) which is set in 1000. Length of the time series is established in object named "*long*" in line 50, and the steps ahead for the forecasting is set in the object "*h.ahead*" in line 51. You can also change the names of the objects where it will be stored the outputs. These names suggested are in lines from 35 to 40 for estimation(to check the missespecification of the distribution), and from 27 to 32 for prediction. Finally, to store the WAIC and DIC criteria in order to check distribution error, use the lines from 43 to 48. In this script, the example is for the student-t distribution, therefore the lines uncommented are 27 and 43 for storing the results of the forecasting and criteria respectively. Note that lines from 35 to 40 are uncommented, this is because the estimation for all distributions is necessary to be stored.

If you change these names, you must be sure that those names must be changed in lines 241, from 257 to 263, an also from 278 to 291. Finally, note that in lines 241, 257 and 258 is stored the criteria(WAIC,DIC), estimation and forecasting for the TRUE distribution error. We suggest change these names when true

distribution is any other in that lines an also in lines from 278 to 280. On average, each replication takes 1.37 mins in a iMac computer 2019, processor 3.0GHz 6-core Intel Core i5(Turbo Boost up to 4.1GHz), memory 8Gb of 2666MHz DDR4 and macOS Sonoma.

For the M2 structure, that is a 2-variate 3 regimes MTAR model

Script for Resume simulations The script named `Resumen_Replicas_3Reg_Final.R` is used to obtain for instance, the results for tables 3, 4 and 6. This script is divided in three parts. Only changes must be made in first part. Second and three parts are only operatives and mainly compute and print(*only*) the results in the R console. We highly recommend to use `source(Resumen_Replicas_3Reg_Final.R)` in order to get only the results in the console. . The results are given for columns(i.e for each distribution of the errors). By default, it is printed the results for Gaussian distribution. Therefore, you have run this script for each distribution only modifying the lines indicated in the script. For instance, if you want the results for the slash distribution you must:

- First, uncomment the line to load the results of the replications for this distribution, in this case, the line 25 load("replicas_slash_1000_3reg1.rds"). Next, comment the line 23(i.e, the line that there is without comment by defect for Gaussian distribution.).
- Change the names in line 32 repl_estimation<-repl_gaussian_estimation. The list repl_slash_estimation replaces repl_gaussian_estimation which contains the results for the estimation.
- Change the names in line 35 repl<-repl_gaussian. The list repl_hyperbolic replaces repl_gaussian which contains the results for the forecasting.
- Change to TRUE the object para.extra in line 45, that is 45 para.extra=TRUE. This is because Slash distribution has extra parameter.
- Run all code using `source(Resumen_Replicas_3Reg_Final.R)` and wait for the results in the console.

Script for running simulations The script named `SimulayEstimaMtar_Replicas3Reg.R` is used to simulate, get the estimation of the parameters, obtain the h.ahead forecasting and store the results for the number of replications set. This script depends on function in `script summarymtar_simulation.R`, therefore this must be ran before running this script.

What is stored? For each replication of the MTAR model simulated, it is stored mainly the estimation of the parameters including the credible intervals and the prediction intervals for each forecast horizon with its respective prediction interval.

What can you modify in the code in order to explore all distributions for errors? Initially, you can modify the distribution error(for instance, you can use: "Gaussian", "Student-t", "Hyperbolic", "Laplace", "Slash", "Contaminated normal") and the extra parameter (check lines 79 and 81). The number of replications is controlled by object "*n_rep*"(see line 15) which is set in 1000. Length of the time series is established in object named "*long*" in line 33, and the steps ahead for the forecasting is set in the object "*h.ahead*" in line 34. You can also change the names of the objects where it will be stored the outputs. These names suggested are in lines from 17 to 22 for estimation, and from 25 to 30 for prediction. In this script, the example is for the slash distribution, therefore the lines uncommented are 21 and 29 for storing the results of the estimation and the forecasting respectively. If you change these names you must be sure that those names must be changed in lines 227(store the estimation), 226(store the forecasting) and 237(store the information). Note that line 237 store extra parameter, however, if distribution does not include this, therefore you must to exclude the object extra. On average, each replication takes 57 seg in a iMac computer 2019, processor 3.0GHz 6-core Intel Core i5(Turbo Boost up to 4.1GHz), memory 8Gb of 2666MHz DDR4, and macOS Sonoma.