Monte Carlo Simulation Results

qonlab

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Contents

1 $\mathbf{Mean}_{S}ingle(20260212Breaks)$

This section contains results for $\text{mean}_{s}ingle(20260212breaks)$.

1.1 $\mathbf{Mean}_{S}ingle(20260212Breaks) - Gaussian$

Table 1: Mean Single Results - Gaussian

Method	RMSE	MAE	Bias
SARIMA + Break Dummy (oracle Tb)	1.1398	1.0641	-0.0498
Simple Exp. Smoothing (SES)	1.1600	1.0012	-0.3293
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

1.2 $\mathbf{Mean}_{S}ingle(20260212Breaks) - Gaussian$

Table 2: Mean Single Results - Gaussian

Method	RMSE	MAE	Bias
SARIMA + Break Dummy (oracle Tb)	1.1276	0.9194	0.1522
Simple Exp. Smoothing (SES)	1.2572	1.0213	0.0017
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

1.3 $\mathbf{Mean}_{S}ingle(20260212Breaks) - Student - tdf3$

Table 3: Mean Single Results - Student-tdf3

Method	RMSE	MAE	Bias
Simple Exp. Smoothing (SES)	0.9825	0.8055	0.1534
SARIMA + Break Dummy (oracle Tb)	1.1240	0.8670	0.1357
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

1.4 $\mathbf{Mean}_{S}ingle(20260212Breaks) - Student - tdf3$

Table 4: Mean Single Results - Student-tdf3

Method	RMSE	MAE	Bias
SARIMA + Break Dummy (oracle Tb)	1.2176	0.8826	0.1855
Simple Exp. Smoothing (SES)	1.2633	0.9438	0.0473
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

Table 5: Mean Single Results - Student-tdf5

Method	RMSE	MAE	Bias
SARIMA + Break Dummy (oracle Tb)	1.1699	0.9351	0.2816
Simple Exp. Smoothing (SES)	1.2290	1.0607	0.3414
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

1.5 $\mathbf{Mean}_{S}single(20260212Breaks) - Student - tdf5$

1.6 $\mathbf{Mean}_{S}single(20260212Breaks) - Student - tdf5$

Table 6: Mean Single Results - Student-tdf5

Method	RMSE	MAE	Bias
SARIMA + Break Dummy (oracle Tb)	1.1782	0.8878	0.3303
Simple Exp. Smoothing (SES)	1.2694	0.9644	0.1962
SARIMA Global	—	—	—
SARIMA Rolling	—	—	—

2 $\mathbf{Parameter}_{S}single(20260212Breaks)$

This section contains results for parameter$_{s}ingle(20260212breaks)$.

2.1 $\mathbf{Parameter}_{S}single(20260212Breaks) - Gaussian$

Table 7: Parameter Single Results - Gaussian

Method	RMSE	MAE	Bias	Variance
MS AR	1.1212	0.9162	-0.2833	1.1768
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

2.2 $\mathbf{Parameter}_{S}single(20260212Breaks) - Gaussian$

Table 8: Parameter Single Results - Gaussian

Method	RMSE	MAE	Bias	Variance
MS AR	1.0735	0.8456	0.0353	1.1512
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

Table 9: Parameter Single Results - Student-tdf3

Method	RMSE	MAE	Bias	Variance
MS AR	3.4101	1.6459	1.0060	10.6166
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

Table 10: Parameter Single Results - Student-tdf3

Method	RMSE	MAE	Bias	Variance
MS AR	1.0502	0.7118	-0.0138	1.1027
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

2.3 $\textbf{Parameter}_{S}single(20260212Breaks) - Student - tdf3$

2.4 $\textbf{Parameter}_{S}single(20260212Breaks) - Student - tdf3$

2.5 $\textbf{Parameter}_{S}single(20260212Breaks) - Student - tdf5$

Table 11: Parameter Single Results - Student-tdf5

Method	RMSE	MAE	Bias	Variance
MS AR	0.8861	0.8291	-0.3022	0.6939
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

2.6 $\textbf{Parameter}_{S}single(20260212Breaks) - Student - tdf5$

Table 12: Parameter Single Results - Student-tdf5

Method	RMSE	MAE	Bias	Variance
MS AR	0.9653	0.7309	0.0408	0.9302
Global SARIMA	—	—	—	—
Rolling SARIMA	—	—	—	—

3 $\textbf{Variance}_{S}single(20260212Breaks)$

This section contains results for variance$_{s}ingle(20260212breaks)$.

Table 13: Variance Single Results - Gaussian

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	1.4769	1.3048	0.2618	2.1126	10
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

Table 14: Variance Single Results - Gaussian

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	2.0535	1.6338	0.2024	4.1759	300
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

Table 15: Variance Single Results - Student-tdf3

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	2.5254	2.0228	0.9078	5.5535	10
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

Table 16: Variance Single Results - Student-tdf3

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	2.0311	1.3335	0.2884	4.0423	300
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

Table 17: Variance Single Results - Student-tdf5

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	3.0309	2.2810	2.1353	4.6272	10
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

Table 18: Variance Single Results - Student-tdf5

Method	RMSE	MAE	Bias	Variance	Successes
GARCH	2.2438	1.5575	0.1922	4.9975	300
SARIMA Global	—	—	—	—	0
SARIMA Rolling	—	—	—	—	0
SARIMA Avg-Window	—	—	—	—	0

3.1 $\mathbf{Variance}_{single}(20260212Breaks) - Gaussian$

3.2 $\mathbf{Variance}_{single}(20260212Breaks) - Gaussian$

3.3 $\mathbf{Variance}_{single}(20260212Breaks) - Student - tdf3$

3.4 $\mathbf{Variance}_{single}(20260212Breaks) - Student - tdf3$

3.5 $\mathbf{Variance}_{single}(20260212Breaks) - Student - tdf5$

3.6 $\mathbf{Variance}_{single}(20260212Breaks) - Student - tdf5$

A Simulation Configuration

- Number of simulations: 300
- Time series length: 400
- Break point: 200 (single breaks)
- Rolling window size: 70
- Forecast horizon: 1-step ahead

B Innovation Types

- **Gaussian**: Standard normal distribution
- **Student-t(df=5)**: Heavy-tailed with 5 degrees of freedom
- **Student-t(df=3)**: Heavier-tailed with 3 degrees of freedom

C Methods

- **GARCH**: Generalized Autoregressive Conditional Heteroscedasticity
- **SARIMA Global**: Full-sample SARIMA fit
- **SARIMA Rolling**: Rolling-window SARIMA forecasts
- **SARIMA Avg-Window**: Average of rolling-window predictions
- **SARIMAX**: SARIMA with exogenous break dummy variable
- **SES**: Simple Exponential Smoothing
- **MS-AR**: Markov-switching autoregressive model