Structural Break Analysis Results

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Executive Summary

Study Overview:

- **Simulation Design:** Monte Carlo experiments with 5 replications per scenario
- **Time Series Length:** T = 400 observations, break point Tb = 200
- **Break Types Analyzed:** Variance, Mean, and Parameter breaks
- **Innovation Types:** Gaussian, Student-t(df=3, 5)
- **Persistence Levels:** 0.90, 0.95, 0.99
- **Total Scenarios:** 138 forecast results across 3 break types

Key Findings:

- **Best Overall Method:** Rolling SARIMA achieves lowest RMSE of 0.9106
- **Predictive Performance (Variance):** Average Coverage@95%: 0.8926, Average LogScore: -2.2044
- **Analysis Status:** Results compiled from all available simulations

1 Mean Break

1.1 Single Break

Table 1: Mean Single Break (Gaussian): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
SARIMA + Break Dummy (oracle Tb)	0.9789	0.7607	0.1568	0.9336
Simple Exp. Smoothing (SES)	1.0598	0.8488	0.0644	1.1190
Holt-Winters (additive)	1.0979	0.8643	0.0266	1.2047
SARIMA Rolling	1.1424	0.9059	0.1833	1.2715
SARIMA Global	1.1482	0.8985	0.3800	1.1741

Table 2: Mean Single Break (Student-t df=3): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
SARIMA + Break Dummy (oracle Tb)	1.1056	0.7405	0.1655	1.1950
Simple Exp. Smoothing (SES)	1.1328	0.7774	0.0644	1.2790
Holt-Winters (additive)	1.1371	0.8046	0.0457	1.2910
SARIMA Rolling	1.2195	0.8434	0.2114	1.4424
SARIMA Global	1.2284	0.8695	0.3984	1.3502

Table 3: Mean Single Break (Student-t df=5): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
SARIMA + Break Dummy (oracle Tb)	1.0610	0.7785	0.1451	1.1046
Simple Exp. Smoothing (SES)	1.1278	0.8284	0.0363	1.2707
Holt-Winters (additive)	1.1599	0.8561	-0.0054	1.3454
SARIMA Rolling	1.2033	0.8659	0.2105	1.4037
SARIMA Global	1.2419	0.9227	0.3903	1.3899

1.2 Recurring Break

Table 4: Mean Recurring: 300 simulations

Method	RMSE	MAE	Bias	Var(error)
SARIMA + Break Dummy (oracle Tb)	1.0957	0.8906	0.0287	1.1997
SARIMA Global	1.1253	0.9019	0.1931	1.2290
SARIMA Rolling	1.1504	0.9285	0.1919	1.2867
Simple Exp. Smoothing (SES)	1.1548	0.9101	0.0267	1.3329
Holt-Winters (additive)	1.1798	0.9235	0.0114	1.3918

2 Parameter Break

2.1 Single Break

Table 5: Parameter Single Break (Gaussian): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
MS AR	1.0735	0.8456	0.0353	1.1512
Rolling SARIMA	1.0950	0.8651	0.0433	1.1971
Global SARIMA	1.1702	0.9297	0.0288	1.3685

Table 6: Parameter Single Break (Student-t df=3): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
Rolling SARIMA	0.9106	0.6792	0.0212	0.8287
MS AR	1.0502	0.7118	-0.0138	1.1027
Global SARIMA	1.0931	0.7951	0.0526	1.1921

Table 7: Parameter Single Break (Student-t df=5): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
MS AR	0.9653	0.7309	0.0408	0.9302
Rolling SARIMA	0.9781	0.7510	0.0143	0.9565
Global SARIMA	1.0476	0.8032	0.0124	1.0973

2.2 Persistence Results

Table 8: Parameter Recurring (p=09): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
MS AR	1.1426	0.8922	0.0253	1.3049
Global SARIMA	1.1695	0.9117	0.0041	1.3676
Rolling SARIMA	1.1875	0.9257	0.0059	1.4100

Table 9: Parameter Recurring (p=095): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
MS AR	1.0778	0.8570	0.0408	1.1600
Rolling SARIMA	1.1215	0.8990	-0.0027	1.2578
Global SARIMA	1.1238	0.8952	-0.0114	1.2627

Table 10: Parameter Recurring (p=099): 300 simulations

Method	RMSE	MAE	Bias	Var(error)
MS AR	1.0318	0.8043	-0.0102	1.0645
Rolling SARIMA	1.0668	0.8408	-0.0123	1.1380
Global SARIMA	1.0974	0.8515	-0.0582	1.2009

3 Variance Break

3.1 Single Break

Table 11: Variance Single Break (Gaussian): 300 simulations

Method	RMSE	MAE	Bias	Variance	LogScore
SARIMA Avg-Window	2.0518	1.6331	0.1884	4.1746	-2.2981
GARCH	2.0535	1.6338	0.2024	4.1759	-2.2569
SARIMA Global	2.0610	1.6356	0.2094	4.2040	-2.4520
SARIMA Rolling	2.0688	1.6423	0.1924	4.2430	-2.2781

Table 12: Variance Single Break (Student-t df=3): 300 simulations

Method	RMSE	MAE	Bias	Variance	LogScore
GARCH	2.0311	1.3335	0.2884	4.0423	-2.1884
SARIMA Global	2.0360	1.3406	0.3010	4.0548	-2.3739
SARIMA Rolling	2.0548	1.3649	0.2966	4.1342	-2.1548
SARIMA Avg-Window	2.0576	1.3688	0.2856	4.1520	-2.2049

Table 13: Variance Single Break (Student-t df=5): 300 simulations

Method	RMSE	MAE	Bias	Variance	LogScore
SARIMA Avg-Window	2.2381	1.5678	0.1849	4.9751	-2.4155
GARCH	2.2438	1.5575	0.1922	4.9975	-2.3550
SARIMA Global	2.2517	1.5617	0.1993	5.0306	-2.6524
SARIMA Rolling	2.2551	1.5607	0.2086	5.0422	-2.3774

3.2 Recurring Break

Table 14: Variance Recurring: 300 simulations

Method	RMSE	MAE	Bias	Variance	LogScore
SARIMA Global	1.6018	1.2311	-0.1129	2.5532	-1.8845
MS AR(1)	1.6031	1.2303	-0.1114	2.5575	-2.1097
SARIMA Rolling	1.6237	1.2554	-0.1145	2.6233	-1.8654
SARIMA Avg-Window	1.6247	1.2484	-0.0935	2.6309	-1.8874

4 Combined Results

[H] aligned$_{b}reaks_{2}$0260213$_{2}$24850 :?$simulations$

Method	RMSE	MAE	Bias	Variance	Coverage80	Coverage95	LogScore	Var
SARIMA Avg-Window	2.0518	1.6331	0.1884	4.1746	0.6767	0.8733	-2.2981	
GARCH	2.0535	1.6338	0.2024	4.1759	0.7733	0.9133	-2.2569	
SARIMA Global	2.0610	1.6356	0.2094	4.2040	0.5867	0.8000	-2.4520	
SARIMA Rolling	2.0688	1.6423	0.1924	4.2430	0.7500	0.9067	-2.2781	
SARIMA Avg-Window	2.2381	1.5678	0.1849	4.9751	0.7200	0.8767	-2.4155	
GARCH	2.2438	1.5575	0.1922	4.9975	0.7667	0.8867	-2.3550	
SARIMA Global	2.2517	1.5617	0.1993	5.0306	0.6600	0.8233	-2.6524	
SARIMA Rolling	2.2551	1.5607	0.2086	5.0422	0.7767	0.8967	-2.3774	
GARCH	2.0311	1.3335	0.2884	4.0423	0.7900	0.8900	-2.1884	
SARIMA Global	2.0360	1.3406	0.3010	4.0548	0.7300	0.8633	-2.3739	
SARIMA Rolling	2.0548	1.3649	0.2966	4.1342	0.8000	0.8933	-2.1548	
SARIMA Avg-Window	2.0576	1.3688	0.2856	4.1520	0.7833	0.8767	-2.2049	
SARIMA Global	1.6018	1.2311	-0.1129	2.5532	0.8367	0.9433	-1.8845	
MS AR(1)	1.6031	1.2303	-0.1114	2.5575	0.8067	0.8967	-2.1097	
SARIMA Rolling	1.6237	1.2554	-0.1145	2.6233	0.7933	0.9433	-1.8654	
SARIMA Avg-Window	1.6247	1.2484	-0.0935	2.6309	0.8067	0.9433	-1.8874	
SARIMA + Break Dummy (oracle Tb)	0.9789	0.7607	0.1568	NaN	NA	NA	NA	
Simple Exp. Smoothing (SES)	1.0598	0.8488	0.0644	NaN	NA	NA	NA	
Holt-Winters (additive)	1.0979	0.8643	0.0266	NaN	NA	NA	NA	
SARIMA Rolling	1.1424	0.9059	0.1833	NaN	NA	NA	NA	
SARIMA Global	1.1482	0.8985	0.3800	NaN	NA	NA	NA	
SARIMA + Break Dummy (oracle Tb)	1.0610	0.7785	0.1451	NaN	NA	NA	NA	
Simple Exp. Smoothing (SES)	1.1278	0.8284	0.0363	NaN	NA	NA	NA	
Holt-Winters (additive)	1.1599	0.8561	-0.0054	NaN	NA	NA	NA	
SARIMA Rolling	1.2033	0.8659	0.2105	NaN	NA	NA	NA	
SARIMA Global	1.2419	0.9227	0.3903	NaN	NA	NA	NA	
SARIMA + Break Dummy (oracle Tb)	1.1056	0.7405	0.1655	NaN	NA	NA	NA	
Simple Exp. Smoothing (SES)	1.1328	0.7774	0.0644	NaN	NA	NA	NA	
Holt-Winters (additive)	1.1371	0.8046	0.0457	NaN	NA	NA	NA	
SARIMA Rolling	1.2195	0.8434	0.2114	NaN	NA	NA	NA	
SARIMA Global	1.2284	0.8695	0.3984	NaN	NA	NA	NA	
SARIMA + Break Dummy (oracle Tb)	1.0957	0.8906	0.0287	NaN	NA	NA	NA	
SARIMA Global	1.1253	0.9019	0.1931	NaN	NA	NA	NA	
SARIMA Rolling	1.1504	0.9285	0.1919	NaN	NA	NA	NA	
Simple Exp. Smoothing (SES)	1.1548	0.9101	0.0267	NaN	NA	NA	NA	
Holt-Winters (additive)	1.1798	0.9235	0.0114	NaN	NA	NA	NA	
MS AR	1.0735	0.8456	0.0353	NaN	NA	NA	NA	
Rolling SARIMA	1.0950	0.8651	0.0433	NaN	NA	NA	NA	
Global SARIMA	1.1702	0.9297	0.0288	NaN	NA	NA	NA	
MS AR	0.9653	0.7309	0.0408	NaN	NA	NA	NA	
Rolling SARIMA	0.9781	0.7510	0.0143	NaN	NA	NA	NA	
Global SARIMA	1.0476	0.8032	0.0124	NaN	NA	NA	NA	
Rolling SARIMA	0.9106	0.6792	0.0212	NaN	NA	NA	NA	
MS AR	1.0502	0.7118	-0.0138	NaN	NA	NA	NA	
Global SARIMA	1.0931	0.7951	0.0526	NaN	NA	NA	NA	
MS AR	1.1426	0.8922	0.0253	NaN	NA	NA	NA	
Global SARIMA	1.1695	0.9117	0.0041	NaN	NA	NA	NA	
Rolling SARIMA	1.1875	0.9257	0.0059	NaN	NA	NA	NA	
MS AR	1.0778	0.8570	0.0408	NaN	NA	NA	NA	
Rolling SARIMA	1.1215	0.8990	-0.0027	NaN	NA	NA	NA	

Global SARIMA	1.1238	0.8952	-0.0114	NaN	NA	NA	NA
MS AR	1.0318	0.8043	-0.0102	NaN	NA	NA	NA
Rolling SARIMA	1.0668	0.8408	-0.0123	NaN	NA	NA	NA
Global SARIMA	1.0974	0.8515	-0.0582	NaN	NA	NA	NA