Results Summary

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Four methods are used to generate base forecasts. Either base forecasts are drawn from an independent distribution or dependent distribution (all DGPs actually have dependence). Also base forecasts are Gaussian or use bootstrapping (the DGPs may be Gaussian or non-Gaussian). The following reconciliation methods are considered

- Base: Not a reconciliation method, just the base forecasts.
- BottomUp: Bottom up
- BTTH: Ben Taieb, Taylor Hyndman (2020). This is like bottom up but reorders a sample from probabilistic forecast to match the empirical copula. Also the mean is adjusted to be the same as that from MinT reconciliation.
- JPP: Jeon Panagiotelis Petropoulos (2019). This reorders a sample from the probabilistic forecast to be perfectly dependent, i.e. it reconciles quantiles. Reconciliation is done by WLS (structural)
- MinTSam: MinT with the usual sample covariance estimator
- MinTShr: MinT with shrinkage covariance estimator
- OLS: OLS reconciliation
- ScoreOptE: Energy score Optimisation by stochastic gradient descent.
- ScoreOptEIn: Energy score Optimisation by stochastic gradient descent but with predicted values (in-sample) used instead of rolling window forecasts.
- ScoreOptV: Variogram score Optimisation by stochastic gradient descent.
- ScoreOptVIn: Variogram score Optimisation by stochastic gradient descent but with predicted values (in-sample) used instead of rolling window forecasts.
- WLS: Weighted least squares using structural scaling.

Table 1: Mean energy score for ets modelling with a nongaussian nonstationary DGP

Method	independent_bootstrap	independent_gaussian	joint_bootstrap	joint_gaussian
Base	1.5826	1.5843	1.5478	1.5471
BottomUp	1.7608	1.7640	1.7387	1.7387
BTTH	3.2943	3.3370	3.3061	3.3370
JPP	3.2011	3.2457	3.2005	3.2220
MinTSam	1.5596	1.5666	1.4173	1.4169
MinTShr	1.4543	1.4564	1.4161	1.4158
OLS	1.4841	1.4834	1.4547	1.4547
ScoreOptE	1.5371	1.5381	1.4772	1.4764
ScoreOptEIn	2.2212	2.2346	2.3677	2.4038
ScoreOptV	1.5036	1.5126	1.4652	1.4785
ScoreOptVIn	1.5115	1.5033	1.4890	1.4811
WLS	1.5433	1.5430	1.5157	1.5157

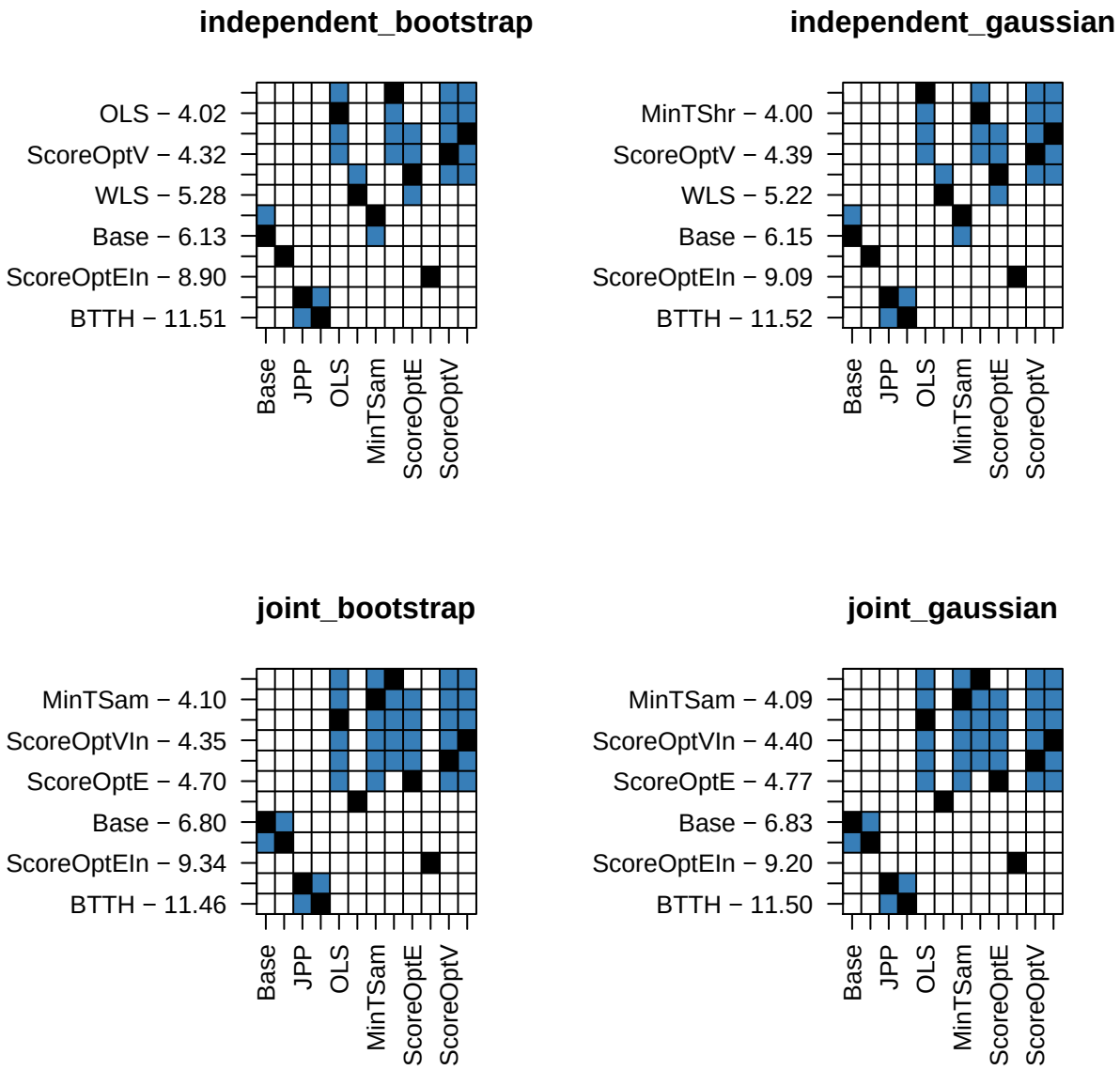

Figure 1: Nemenyi matrix for ets modelling with a nongaussian nonstationary DGP using energy score

Table 2: Mean variogram score for ets modelling with a nongaussian nonstationary DGP

Method	independent_bootstrap	independent_gaussian	joint_bootstrap	joint_gaussian
Base	34.7939	34.7987	34.7991	34.7948
BottomUp	37.1996	37.2374	37.1947	37.2114
BTTH	41.9804	42.2408	42.2279	42.1411
JPP	33.9124	33.9234	33.9093	33.9210
MinTSam	32.2922	32.2859	32.2854	32.2912
MinTShr	32.2571	32.2526	32.2511	32.2525
OLS	33.3277	33.3328	33.3241	33.3310
ScoreOptE	33.9771	33.9845	33.7230	33.6864
ScoreOptEIn	42.2906	42.3044	45.3307	46.7487
ScoreOptV	33.8142	34.4903	33.7546	34.1337
ScoreOptVIn	34.3905	33.7814	34.6520	34.1796
WLS	33.9120	33.9230	33.9065	33.9179

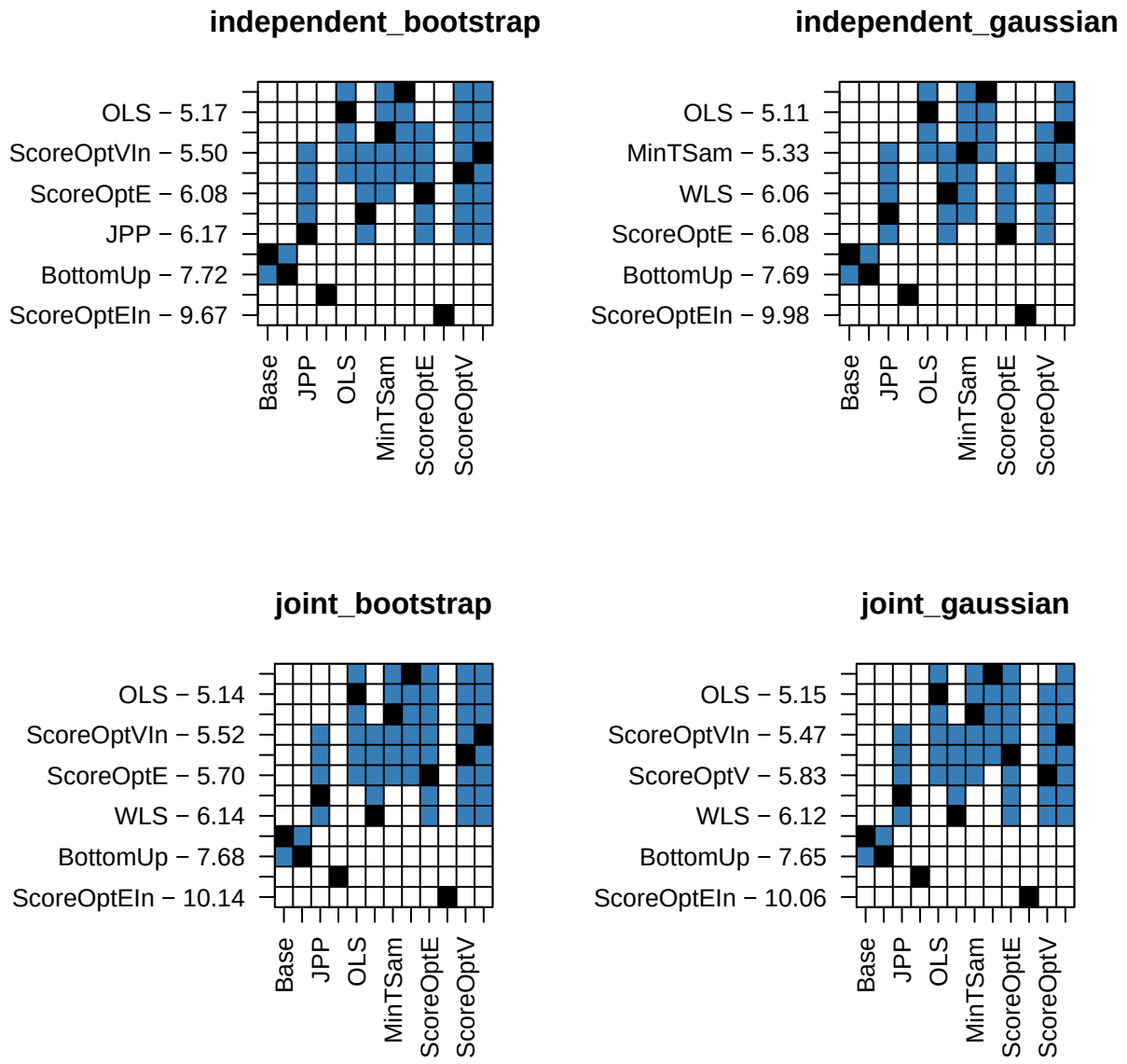

Figure 2: Nemenyi matrix for ets modelling with a nongaussian nonstationary DGP using variogram score