

Consistent and Scalable Variable Selection with Robust Link Functions

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A Simulation

This section presents additional simulation results for $p \in \{100, 500\}$, evaluating the performance of t -links, the logit link, and the probit link in variable selection under contaminated datasets. A total of thirteen models were compared, consisting of ten Bayesian methods (HSGT, HEGT, SLogit, ELogit, SProbit, and EProbit) and the frequentist LASSO, each implemented with three different link functions (Cauchy, logit, and probit), as described in the main text. We consider two correlation structures for the design matrix: independent and AR(1). The true model contains $|\mathbf{k}| = 4$ active covariates with coefficients $\boldsymbol{\beta}_k = (3, 1.5, 1.0, 0.5)'$.

Tables S1 and S4 report the average metrics from simulations using data generated from the t -link model ($\nu = 1$) with $p = 100$ and $p = 500$, respectively. In scenarios without outliers, the SG and EG methods under the Cauchy link ($\nu = 1$) slightly outperform the other methods in variable selection according to the MCC criterion and achieve competitive prediction accuracy (MSPE) when $p = 100$, with SG (Cauchy, $\nu = 1$) attaining the lowest MSPE at $p = 500$. Under both outlier settings (“bad leverage” and “non-leverage”), the SG and EG methods with Cauchy ($\nu = 1$) demonstrate superior variable selection, consistently achieving higher MCC scores and the lowest MSPE among all thirteen models.

Tables S2 and S5 summarize results for data generated from the logit model with $p = 100$ and $p = 500$. Here, SG and EG with either the logit or t -link ($\nu = 7$) show strong performance, particularly at $p = 500$, where they achieve high MCC scores. In the two outlier scenarios, SG and EG with the t -link ($\nu = 1$) again exhibit the highest MCC values, confirming their robustness to contamination. Although the LASSO with logit and probit links attains competitive MCC values under the “non-leverage” outlier case, the Bayesian methods consistently produce lower MSPE values.

Table S3 presents the simulation results for $p = 100$ using data generated from the probit model. As expected, SG and EG with logit and probit links achieve high MCC and low MSPE values. However, in the presence of outliers, SG and EG under the Cauchy link ($\nu = 1$) again deliver the best variable selection and predictive performance compared to all other methods.

Overall, the SG and EG models with the Cauchy link ($\nu = 1$) provide the most robust and reliable performance in the presence of outliers, consistently achieving superior variable selection (high MCC) and prediction accuracy (low MSPE) compared with alternative approaches.

Table S1: Simulation Results: Cauchy Link ($v = 1$) as the True Model ($p=100$)

	Bayesian										LASSO		
	Cauchy ($v = 1$)		t ($v = 3$)		t ($v = 7$)		logit		probit		Cauchy	logit	probit
	SG	EG	SG	EG	SG	EG	SG	EG	SG	EG			
$\Sigma = I$													
	No Outlier												
SEN	0.5500	0.5050	0.5800	0.4950	0.5120	0.4950	0.5350	0.4850	0.5450	0.4800	0.5500	0.5000	0.5050
SPE	0.9944	0.9977	0.9919	0.9973	0.9946	0.9949	0.9946	0.9977	0.9912	0.9973	0.9754	0.9825	0.9825
MCC	0.6562	0.6635	0.6415	0.6516	0.6462	0.6329	0.6482	0.6511	0.6477	0.6413	0.5582	0.5651	0.5680
FP	0.5400	0.2200	0.7800	0.2600	0.5200	0.4200	0.5200	0.2200	0.8400	0.2600	2.3600	1.6800	1.6800
FN	1.8000	1.9800	1.8400	2.0200	1.9520	2.0200	1.8400	2.0600	1.8200	2.0800	1.8000	2.0000	1.9800
MSPE	0.1560	0.1550	0.1567	0.1568	0.1540	0.1572	0.1547	0.1551	0.1569	0.1605	0.1790	0.1780	0.1784
	Bad Leverage Outlier												
SEN	0.5300	0.5200	0.5240	0.4500	0.5100	0.3500	0.4850	0.3650	0.4650	0.3056	0.5200	0.0400	0.0050
SPE	0.9960	0.9981	0.9951	0.9983	0.9933	0.9971	0.9933	0.9973	0.9804	0.9925	0.9792	0.9998	1.0000
MCC	0.6618	0.6806	0.6511	0.6223	0.6191	0.5049	0.5969	0.5207	0.4677	0.4071	0.5457	0.0589	0.0098
FP	0.3800	0.1800	0.4400	0.1600	0.6400	0.2800	0.6400	0.2600	1.8800	0.7222	2.0000	0.0200	0.0000
FN	1.8800	1.9200	1.9000	2.2000	1.9600	2.6000	2.0600	2.5400	2.1400	2.7778	1.9200	3.8400	3.9800
MSPE	0.1538	0.1518	0.1569	0.1630	0.1744	0.1926	0.1775	0.1888	0.2224	0.2421	0.1877	0.2478	0.2499
	Non-leverage Outlier												
SEN	0.5400	0.5050	0.5400	0.4250	0.4900	0.3950	0.4750	0.4200	0.4700	0.3850	0.5050	0.4400	0.4250
SPE	0.9944	0.9983	0.9938	0.9981	0.9927	0.9971	0.9935	0.9983	0.9888	0.9973	0.9765	0.9919	0.9906
MCC	0.6521	0.6719	0.6431	0.6115	0.5962	0.5706	0.5913	0.6063	0.5407	0.5633	0.5416	0.5592	0.5545
FP	0.5400	0.1600	0.6000	0.1800	0.7000	0.2800	0.6200	0.1600	1.0800	0.2600	2.2600	0.7800	0.9000
FN	1.8400	1.9800	1.8400	2.3000	2.0400	2.4200	2.1000	2.3200	2.1200	2.4600	1.9800	2.2400	2.3000
MSPE	0.1545	0.1540	0.1570	0.1600	0.1610	0.1641	0.1623	0.1619	0.1678	0.1651	0.1874	0.1939	0.1976
$\Sigma = \Sigma_{ar1}(\rho=0.50)$													
	No Outlier												
SEN	0.5500	0.5150	0.5500	0.5050	0.5550	0.4750	0.5600	0.4850	0.5300	0.4700	0.7200	0.6550	0.6000
SPE	0.9940	0.9979	0.9910	0.9965	0.9910	0.9979	0.9933	0.9962	0.9883	0.9965	0.9627	0.9731	0.9798
MCC	0.6649	0.6758	0.6332	0.6508	0.6311	0.6445	0.6566	0.6334	0.5945	0.6209	0.6242	0.6477	0.6368
FP	0.5800	0.2000	0.8600	0.3400	0.8600	0.2000	0.6400	0.3600	1.1200	0.3400	3.5800	2.5800	1.9400
FN	1.8000	1.9400	1.8000	1.9800	1.7800	2.1000	1.7600	2.0600	1.8800	2.1200	1.1200	1.3800	1.6000
MSPE	0.1360	0.1342	0.1389	0.1385	0.1398	0.1411	0.1361	0.1383	0.1460	0.1435	0.1559	0.1552	0.1557
	Bad Leverage Outlier												
SEN	0.5694	0.5000	0.5150	0.3950	0.4650	0.3000	0.5000	0.3611	0.4722	0.2778	0.6600	0.3850	0.1400
SPE	0.9942	0.9959	0.9906	0.9963	0.9873	0.9954	0.9896	0.9965	0.9774	0.9959	0.9706	0.9967	0.9983
MCC	0.6614	0.6287	0.5942	0.5598	0.5347	0.4582	0.5798	0.5366	0.4745	0.4591	0.6247	0.4925	0.1969
FP	0.5556	0.3889	0.9000	0.3600	1.2200	0.4400	1.0000	0.3333	2.1667	0.3889	2.8200	0.3200	0.1600
FN	1.7222	2.0000	1.9400	2.4200	2.1400	2.8000	2.0000	2.5556	2.1111	2.8889	1.3600	2.4600	3.4400
MSPE	0.1464	0.1511	0.1552	0.1647	0.1790	0.1916	0.1753	0.1833	0.1957	0.1989	0.1714	0.2146	0.2353
	Non-leverage Outlier												
SEN	0.5400	0.5050	0.5300	0.4400	0.4850	0.3750	0.5000	0.4050	0.4300	0.3800	0.6750	0.5200	0.5000
SPE	0.9946	0.9975	0.9925	0.9965	0.9913	0.9965	0.9923	0.9973	0.9862	0.9948	0.9627	0.9917	0.9922
MCC	0.6563	0.6618	0.6268	0.5947	0.5837	0.5533	0.5984	0.5738	0.5031	0.5353	0.6059	0.6251	0.6202
FP	0.5200	0.2400	0.7200	0.3400	0.8400	0.3400	0.7400	0.2600	1.3200	0.5000	3.5800	0.8000	0.7000
FN	1.8400	1.9800	1.8800	2.2400	2.0600	2.5000	2.0000	2.3800	2.2800	2.4800	1.3000	1.9200	2.0000
MSPE	0.1348	0.1367	0.1376	0.1436	0.1465	0.1483	0.1441	0.1484	0.1601	0.1551	0.1626	0.1753	0.1839

Table S2: Simulation Results: Logit link as the True Model (p=100)

	Bayesian										LASSO		
	Cauchy ($v = 1$)		t ($v = 3$)		t ($v = 7$)		logit		probit		Cauchy	logit	probit
	SG	EG	SG	EG	SG	EG	SG	EG	SG	EG			
$\Sigma = I$													
	No Outlier												
SEN	0.6250	0.5800	0.6700	0.6000	0.6650	0.6200	0.6700	0.6200	0.6850	0.6000	0.7300	0.7200	0.6950
SPE	0.9919	0.9948	0.9885	0.9918	0.9842	0.9913	0.9865	0.9931	0.9860	0.9931	0.9304	0.9556	0.9633
MCC	0.6918	0.6876	0.6903	0.6649	0.6571	0.6794	0.6739	0.7021	0.6795	0.6874	0.5154	0.5806	0.6022
FP	0.7800	0.5000	1.1000	0.5200	1.5200	0.8200	1.3000	0.6600	1.3400	0.6400	6.6800	4.2600	3.5200
FN	1.5000	1.6800	1.3200	1.6000	1.3400	1.5200	1.3200	1.5200	1.2600	1.6000	1.0800	1.1200	1.2200
MSPE	0.1272	0.1266	0.1268	0.1237	0.1304	0.1265	0.1263	0.1240	0.1282	0.1295	0.1438	0.1369	0.1374
	Bad Leverage Outlier												
SEN	0.6200	0.5700	0.6500	0.5750	0.6200	0.5150	0.5800	0.5250	0.5650	0.3750	0.7000	0.0400	0.0000
SPE	0.9917	0.9960	0.9911	0.9955	0.9912	0.9979	0.9950	0.9979	0.9808	0.9913	0.9417	1.0000	1.0000
MCC	0.6858	0.6925	0.6848	0.6942	0.6826	0.6744	0.6923	0.6827	0.5614	0.4913	0.5384	0.0617	0.0000
FP	0.8000	0.3800	0.9000	0.4000	0.9100	0.2000	0.4800	0.2000	1.8400	0.8333	5.6000	0.0000	0.0000
FN	1.5200	1.7200	1.6000	1.7000	1.5200	1.9400	1.6800	1.9000	1.7400	2.5000	1.2000	3.8400	4.0000
MSPE	0.1245	0.1256	0.1199	0.1239	0.1253	0.1336	0.1317	0.1345	0.1957	0.2153	0.1504	0.2473	0.2500
	Non-leverage Outlier												
SEN	0.6050	0.6000	0.6000	0.5650	0.5900	0.5200	0.5800	0.5250	0.5800	0.5050	0.7000	0.5700	0.4700
SPE	0.9925	0.9958	0.9904	0.9918	0.9888	0.9948	0.9902	0.9950	0.9844	0.9933	0.9508	0.9812	0.9833
MCC	0.6815	0.7136	0.6812	0.6703	0.6430	0.6416	0.6452	0.6518	0.5908	0.6196	0.5477	0.6022	0.5516
FP	0.7200	0.4000	0.9200	0.7900	1.0800	0.5000	0.9400	0.4800	1.5000	0.6400	4.7200	1.8000	1.6000
FN	1.5800	1.6000	1.6000	1.7400	1.6400	1.9200	1.6800	1.9000	1.6800	1.9800	1.2000	1.7200	2.1200
MSPE	0.1246	0.1226	0.1248	0.1251	0.1286	0.1310	0.1295	0.1301	0.1377	0.1385	0.1506	0.1600	0.1689
$\Sigma = \Sigma_{ar1}(\rho=0.50)$													
	No Outlier												
SEN	0.5700	0.5300	0.5650	0.5150	0.5650	0.4750	0.5550	0.4900	0.5600	0.4900	0.8200	0.8150	0.8000
SPE	0.9910	0.9969	0.9923	0.9969	0.9908	0.9956	0.9921	0.9973	0.9912	0.9952	0.9346	0.9608	0.9579
MCC	0.6524	0.6741	0.6491	0.6635	0.6329	0.6181	0.6421	0.6500	0.6406	0.6250	0.5773	0.6543	0.6507
FP	0.8600	0.3000	0.7400	0.3000	0.8800	0.4200	0.7600	0.2600	0.8400	0.4600	6.2800	3.7600	4.0400
FN	1.7200	1.8800	1.7400	1.9400	1.7400	2.1000	1.7800	2.0400	1.7600	2.0400	0.7200	0.7400	0.8000
MSPE	0.0916	0.0885	0.0911	0.0865	0.0950	0.0920	0.0904	0.0893	0.0898	0.0916	0.1059	0.0980	0.0982
	Bad Leverage Outlier												
SEN	0.5417	0.4861	0.4850	0.3600	0.4350	0.3100	0.4861	0.3333	0.4444	0.3194	0.7850	0.6000	0.2000
SPE	0.9919	0.9971	0.9881	0.9948	0.9825	0.9921	0.9826	0.9919	0.9786	0.9931	0.9469	0.9800	0.9973
MCC	0.6240	0.6378	0.5582	0.5232	0.4634	0.4396	0.5088	0.4620	0.4544	0.4599	0.5943	0.6221	0.2813
FP	0.7778	0.2778	1.1400	0.5000	1.6800	0.7600	1.6667	0.7778	2.0556	0.6667	5.1000	1.9200	0.2600
FN	1.8333	2.0556	2.0600	2.5600	2.2600	2.7600	2.0556	2.6667	2.2222	2.7222	0.8600	1.6000	3.2000
MSPE	0.0995	0.1003	0.1174	0.1218	0.1382	0.1421	0.1353	0.1365	0.1502	0.1421	0.1272	0.1655	0.2170
	Non-leverage Outlier												
SEN	0.5750	0.5000	0.4950	0.4550	0.4700	0.3850	0.4850	0.4000	0.3850	0.3150	0.7850	0.6000	0.5500
SPE	0.9935	0.9981	0.9950	0.9983	0.9948	0.9979	0.9946	0.9977	0.9835	0.9925	0.9494	0.9856	0.9843
MCC	0.6667	0.6683	0.6301	0.6364	0.6083	0.5758	0.6122	0.5849	0.4342	0.4489	0.5986	0.6531	0.6382
FP	0.6200	0.1800	0.4800	0.1600	0.5000	0.2000	0.5200	0.2200	1.5800	0.7200	4.8600	1.3800	1.5072
FN	1.7000	2.0000	2.0200	2.1800	2.1200	2.4600	2.0600	2.4000	2.4600	2.7400	0.8600	1.6000	1.8000
MSPE	0.0901	0.0887	0.0902	0.0885	0.0941	0.0985	0.0967	0.1007	0.1244	0.1274	0.1116	0.1331	0.1526

Table S3: Simulation Results: Probit link as the True Model (p=100)

	Bayesian										LASSO		
	Cauchy ($v = 1$)		t ($v = 3$)		t ($v = 7$)		logit		probit		Cauchy	logit	probit
	SG	EG	SG	EG	SG	EG	SG	EG	SG	EG			
$\Sigma = I$													
	No Outlier												
SEN	0.7300	0.6950	0.7100	0.7050	0.7450	0.7050	0.7450	0.7150	0.7450	0.7150	0.8750	0.8500	0.8100
SPE	0.9946	0.9965	0.9940	0.9962	0.9954	0.9963	0.9942	0.9971	0.9931	0.9958	0.9104	0.9346	0.9460
MCC	0.7828	0.7805	0.7639	0.7861	0.8005	0.7867	0.7892	0.8013	0.7822	0.7895	0.5192	0.5689	0.5807
FP	0.5200	0.3400	0.5800	0.3600	0.4400	0.3600	0.5600	0.2800	0.6600	0.4000	8.6000	6.2800	5.1800
FN	1.0800	1.2200	1.1600	1.1800	1.0200	1.1800	1.0200	1.1400	1.0200	1.1400	0.5000	0.6000	0.7600
MSPE	0.0831	0.0868	0.0862	0.0851	0.0828	0.0871	0.0841	0.0827	0.0846	0.0863	0.1036	0.0970	0.0976
	Bad Leverage Outlier												
SEN	0.7100	0.6700	0.7000	0.6550	0.6850	0.6300	0.6750	0.6150	0.6500	0.5278	0.8150	0.3350	0.0000
SPE	0.9960	0.9983	0.9969	0.9985	0.9975	0.9985	0.9973	0.9990	0.9798	0.9925	0.9373	0.9960	1.0000
MCC	0.7877	0.7893	0.7899	0.7814	0.7871	0.7648	0.7782	0.7600	0.6132	0.6289	0.5679	0.4258	0.0000
FP	0.3800	0.1600	0.3000	0.1400	0.2400	0.1400	0.2600	0.1000	1.9400	0.7222	6.0200	0.3800	0.0000
FN	1.1600	1.3200	1.2000	1.3800	1.2600	1.4800	1.3000	1.5400	1.4000	1.8889	0.7400	2.6600	4.0000
MSPE	0.0842	0.0843	0.0832	0.0849	0.0895	0.0912	0.0935	0.0929	0.1742	0.1818	0.1146	0.2174	0.2500
	Non-leverage Outlier												
SEN	0.6450	0.6750	0.6800	0.6950	0.6350	0.5950	0.6400	0.6200	0.6050	0.5450	0.8350	0.6450	0.4950
SPE	0.9981	0.9977	0.9963	0.9948	0.9958	0.9979	0.9958	0.9975	0.9860	0.9960	0.9321	0.9894	0.9965
MCC	0.7704	0.7852	0.7692	0.7649	0.7361	0.7348	0.7401	0.7484	0.6266	0.6751	0.5476	0.6924	0.6486
FP	0.1800	0.2200	0.3600	0.5000	0.4000	0.2000	0.4000	0.2400	1.3400	0.3800	6.5200	1.0200	0.3400
FN	1.4200	1.3000	1.2800	1.2200	1.4600	1.6200	1.4400	1.5200	1.5800	1.8200	0.6600	1.4200	2.0200
MSPE	0.0854	0.0859	0.0851	0.0866	0.0900	0.0942	0.0918	0.0921	0.1090	0.1078	0.1130	0.1376	0.1561
$\Sigma = \Sigma_{ar1}(\rho=0.50)$													
	No Outlier												
SEN	0.6700	0.6500	0.6850	0.6550	0.6800	0.6550	0.6800	0.6700	0.6700	0.6600	0.8450	0.8250	0.8250
SPE	0.9967	0.9990	0.9973	0.9981	0.9969	0.9990	0.9981	0.9992	0.9973	0.9994	0.9146	0.9498	0.9506
MCC	0.7709	0.7858	0.7877	0.7774	0.7806	0.7868	0.7923	0.7990	0.7776	0.7952	0.5125	0.6165	0.6213
FP	0.3200	0.1000	0.2600	0.1800	0.3000	0.1000	0.1800	0.0800	0.2600	0.0600	8.2000	4.8200	4.7400
FN	1.3200	1.4000	1.2600	1.3800	1.2800	1.3800	1.2800	1.3200	1.3200	1.3600	0.6200	0.7000	0.7000
MSPE	0.0721	0.0723	0.0707	0.0722	0.0711	0.0726	0.0691	0.0707	0.0708	0.0727	0.0838	0.0799	0.0798
	Bad Leverage Outlier												
SEN	0.6600	0.6400	0.6389	0.6389	0.6250	0.4650	0.6250	0.4722	0.5278	0.4028	0.8100	0.5950	0.1750
SPE	0.9979	0.9996	0.9959	0.9988	0.9904	0.9963	0.9890	0.9948	0.9821	0.9931	0.9569	0.9944	1.0000
MCC	0.7780	0.7852	0.7439	0.7731	0.6861	0.6161	0.6687	0.5968	0.5320	0.5312	0.6191	0.7212	0.2745
FP	0.2000	0.0400	0.3889	0.1111	0.9200	0.3600	1.0556	0.5000	1.7222	0.6667	4.1400	0.5400	0.0000
FN	1.3600	1.4400	1.4444	1.4444	1.5000	2.1400	1.5000	2.1111	1.8889	2.3889	0.7600	1.6200	3.3000
MSPE	0.0764	0.0789	0.0759	0.0739	0.1144	0.1283	0.1248	0.1370	0.1534	0.1584	0.0997	0.1731	0.2293
	Non-leverage Outlier												
SEN	0.6700	0.6500	0.6500	0.6350	0.6400	0.5750	0.6200	0.5900	0.5700	0.4900	0.8200	0.6500	0.5550
SPE	0.9977	0.9996	0.9962	0.9994	0.9967	0.9983	0.9977	0.9985	0.9854	0.9942	0.9417	0.9962	0.9988
MCC	0.7838	0.7917	0.7529	0.7788	0.7533	0.7271	0.7509	0.7388	0.6002	0.6161	0.5763	0.7530	0.7164
FP	0.2200	0.0400	0.3600	0.0600	0.3200	0.1600	0.2200	0.1400	1.4000	0.5600	5.6000	0.3600	0.1200
FN	1.3200	1.4000	1.4000	1.4600	1.4400	1.7000	1.5200	1.6400	1.7200	2.0400	0.7200	1.4000	1.7800
MSPE	0.0702	0.0715	0.0728	0.0731	0.0763	0.0793	0.0777	0.0777	0.1072	0.1025	0.0922	0.1225	0.1474

Table S4: Simulation Results: Cauchy Link ($v = 1$) as the True Model (p=500)

	Bayesian										LASSO		
	Cauchy ($v = 1$)		t ($v = 3$)		t ($v = 7$)		logit		probit		Cauchy	logit	probit
	SG	EG	SG	EG	SG	EG	SG	EG	SG	EG			
$\Sigma = I$													
	No Outlier												
SEN	0.4250	0.3650	0.4100	0.3700	0.4200	0.3900	0.4150	0.3750	0.4350	0.4050	0.5300	0.4700	0.4700
SPE	0.9989	0.9993	0.9983	0.9992	0.9978	0.9990	0.9987	0.9993	0.9980	0.9986	0.9890	0.9920	0.9934
MCC	0.5711	0.5450	0.5306	0.5438	0.5253	0.5484	0.5539	0.5513	0.5236	0.5436	0.4484	0.4626	0.4474
FP	0.3000	0.3400	0.8600	0.4200	1.1000	0.5200	0.6400	0.3600	1.2000	0.4000	5.4600	4.2000	3.8200
FN	2.3000	2.5400	2.3600	2.5200	2.3200	2.4400	2.3400	2.5000	2.2600	2.3800	1.8800	2.1200	2.1200
MSPE	0.1705	0.1738	0.1762	0.1826	0.1803	0.1832	0.1720	0.1742	0.1854	0.1850	0.1881	0.1856	0.1836
	Bad Leverage Outlier												
SEN	0.3650	0.3500	0.4000	0.2650	0.3300	0.1650	0.3200	0.1650	0.3250	0.1450	0.4500	0.0350	0.0100
SPE	0.9993	0.9996	0.9987	0.9994	0.9980	0.9993	0.9990	0.9994	0.9966	0.9998	0.9925	0.9990	0.9998
MCC	0.5421	0.5466	0.5346	0.4217	0.4509	0.2734	0.4718	0.2751	0.3618	0.2278	0.4369	0.0428	0.0066
FP	0.3600	0.2200	0.6600	0.3200	0.9800	0.3400	0.5200	0.2800	1.9600	0.4000	3.7200	0.4600	0.1400
FN	2.5400	2.6000	2.4000	2.9400	2.6800	3.3400	2.7200	3.3400	2.7000	3.4200	2.2000	3.8600	3.9600
MSPE	0.1683	0.1713	0.1759	0.2135	0.2165	0.2496	0.2031	0.2364	0.2610	0.2606	0.2020	0.2482	0.2494
	Non-leverage Outlier												
SEN	0.3800	0.3450	0.3850	0.3300	0.3650	0.3250	0.3550	0.3150	0.3500	0.3300	0.4350	0.3900	0.4000
SPE	0.9990	0.9995	0.9983	0.9993	0.9980	0.9992	0.9986	0.9995	0.9988	0.9996	0.9929	0.9936	0.9942
MCC	0.5388	0.5447	0.5092	0.5204	0.4862	0.5093	0.5081	0.5165	0.4532	0.5042	0.4441	0.4280	0.4650
FP	0.5000	0.2600	0.8600	0.3400	0.9800	0.3800	0.6800	0.2600	1.2000	0.5200	3.5200	3.3000	3.0600
FN	2.4800	2.6200	2.4600	2.6800	2.5400	2.7000	2.5800	2.7400	2.6000	2.6800	2.2600	2.4400	2.4000
MSPE	0.1689	0.1734	0.1769	0.1795	0.1837	0.1832	0.1750	0.1725	0.1924	0.1898	0.1990	0.2004	0.2002
$\Sigma = \Sigma_{ar1}(\rho=0.50)$													
	No Outlier												
SEN	0.4550	0.3950	0.4550	0.3850	0.4350	0.3850	0.4400	0.3800	0.4150	0.3800	0.7050	0.6850	0.6900
SPE	0.9992	0.9993	0.9992	0.9996	0.9987	0.9993	0.9992	0.9996	0.9996	0.9998	0.9883	0.9904	0.9892
MCC	0.6178	0.5784	0.6140	0.5819	0.5779	0.5734	0.6029	0.5783	0.5320	0.5690	0.5902	0.5916	0.6028
FP	0.4000	0.3400	0.4000	0.2200	0.6600	0.3400	0.3800	0.2200	0.8800	0.3200	5.7800	4.0600	6.0200
FN	2.1800	2.4200	2.1800	2.4600	2.2600	2.4600	2.2400	2.4800	2.3400	2.4800	1.0600	1.2600	1.2400
MSPE	0.1410	0.1517	0.1458	0.1548	0.1527	0.1565	0.1456	0.1523	0.1630	0.1622	0.1588	0.1552	0.1552
	Bad Leverage Outlier												
SEN	0.4050	0.3350	0.3700	0.2900	0.3550	0.2550	0.3600	0.2850	0.3500	0.2800	0.6050	0.4150	0.1650
SPE	0.9994	0.9995	0.9986	0.9992	0.9982	0.9994	0.9988	0.9994	0.9986	1.0000	0.9988	0.9983	1.0000
MCC	0.5847	0.5356	0.5195	0.4817	0.4828	0.4475	0.5106	0.4886	0.4604	0.4616	0.5902	0.5546	0.2854
FP	0.3000	0.2400	0.6800	0.3800	0.9200	0.2800	0.6000	0.2800	1.1400	0.4400	3.5600	0.8800	0.0200
FN	2.3800	2.6600	2.5200	2.8400	2.5800	2.9800	2.5600	2.8600	2.6000	2.8800	1.3800	2.3400	3.3400
MSPE	0.1536	0.1658	0.1724	0.1847	0.1857	0.1932	0.1741	0.1798	0.1926	0.1954	0.1798	0.2116	0.2324
	Non-leverage Outlier												
SEN	0.4100	0.3750	0.3800	0.3200	0.3850	0.2900	0.3700	0.2950	0.3550	0.2850	0.6100	0.5550	0.5000
SPE	0.9996	0.9997	0.9990	0.9997	0.9989	0.9996	0.9995	0.9997	0.9986	1.0000	0.9924	0.9951	0.9989
MCC	0.5852	0.5810	0.5483	0.5290	0.5461	0.4999	0.5632	0.5079	0.4786	0.4850	0.5901	0.5838	0.5866
FP	0.2000	0.1600	0.5000	0.1600	0.5600	0.2000	0.2600	0.1600	1.0600	0.2800	3.6600	2.2800	0.5600
FN	2.3200	2.5000	2.4800	2.7200	2.4600	2.8400	2.5200	2.8200	2.5800	2.8600	1.4600	1.7800	2.0000
MSPE	0.1447	0.1483	0.1526	0.1565	0.1588	0.1652	0.1522	0.1580	0.1788	0.1716	0.1684	0.1758	0.1816

Table S5: Simulation Results: Logit as the True Model (p=500)

	Bayesian										LASSO		
	Cauchy ($v = 1$)		t ($v = 3$)		t ($v = 7$)		logit		probit		Cauchy	logit	probit
	SG	EG	SG	EG	SG	EG	SG	EG	SG	EG			
$\Sigma = I$													
	No Outlier												
SEN	0.4850	0.4700	0.5100	0.5000	0.5450	0.4750	0.5150	0.5000	0.5180	0.4800	0.6300	0.6000	0.5950
SPE	0.9992	0.9994	0.9991	0.9996	0.9994	0.9995	0.9993	0.9993	1.0000	0.9998	0.9828	0.9884	0.9902
MCC	0.6377	0.6416	0.6511	0.6685	0.7105	0.6472	0.6664	0.6609	0.6490	0.6440	0.4702	0.5250	0.5116
FP	0.4000	0.3000	0.4600	0.2200	0.3200	0.2600	0.3400	0.3200	0.5200	0.2600	8.5200	5.6800	5.1000
FN	2.0600	2.1200	1.9600	2.0000	1.7400	2.1000	1.9400	2.0000	1.8200	2.0800	1.4800	1.6000	1.6200
MSPE	0.1379	0.1432	0.1390	0.1472	0.1367	0.1519	0.1341	0.1375	0.1412	0.1506	0.1582	0.1516	0.1496
	Bad Leverage Outlier												
SEN	0.4900	0.4200	0.4800	0.4450	0.4450	0.2850	0.4400	0.3300	0.4350	0.2450	0.5900	0.0400	0.0000
SPE	0.9997	0.9999	0.9997	0.9999	0.9997	0.9996	0.9996	0.9998	0.9992	1.0000	0.9879	0.9998	1.0000
MCC	0.6713	0.6300	0.6639	0.6471	0.6317	0.4547	0.6292	0.5148	0.5234	0.3902	0.4950	0.0536	0.0000
FP	0.1400	0.0400	0.1400	0.0600	0.1400	0.1800	0.1800	0.1200	1.2600	0.2200	6.0200	0.1400	0.0000
FN	2.0400	2.3200	2.0800	2.2200	2.2200	2.8600	2.2400	2.6800	2.2600	3.0200	1.6400	3.8400	4.0000
MSPE	0.1357	0.1415	0.1343	0.1445	0.1441	0.1964	0.1484	0.1739	0.2056	0.2188	0.1664	0.2470	0.2500
	Non-leverage Outlier												
SEN	0.4250	0.4250	0.4250	0.3950	0.4450	0.3850	0.4250	0.3850	0.4350	0.4050	0.5450	0.4600	0.4350
SPE	0.9997	0.9999	0.9994	0.9995	0.9985	0.9997	0.9992	0.9994	0.9988	0.9996	0.9868	0.9950	0.9962
MCC	0.6207	0.6327	0.6129	0.5895	0.5769	0.5871	0.5896	0.5777	0.5394	0.5962	0.4732	0.5190	0.5154
FP	0.1600	0.0600	0.3200	0.2400	0.7600	0.1600	0.4200	0.2800	1.0200	0.2800	6.5600	2.5800	2.1000
FN	2.3000	2.3000	2.1800	2.4200	2.2200	2.4600	2.3000	2.4600	2.2600	2.3800	1.8200	2.1600	2.2600
MSPE	0.1409	0.1412	0.1398	0.1525	0.1487	0.1517	0.1420	0.1485	0.1554	0.1550	0.1700	0.1734	0.1794
$\Sigma = \Sigma_{ar1}(\rho=0.50)$													
	No Outlier												
SEN	0.4650	0.3850	0.4500	0.3650	0.4200	0.3750	0.4400	0.3850	0.4400	0.3650	0.7850	0.7700	0.7500
SPE	0.9993	0.9998	0.9992	0.9995	0.9994	0.9995	0.9995	0.9995	0.9996	1.0000	0.9770	0.9874	0.9896
MCC	0.6276	0.5957	0.6013	0.5631	0.5973	0.5665	0.6239	0.5759	0.5986	0.5568	0.4684	0.5750	0.5848
FP	0.3600	0.1000	0.4200	0.2600	0.3200	0.2600	0.2400	0.2400	0.5400	0.2800	11.4000	6.4000	5.1800
FN	2.1400	2.4600	2.2000	2.5400	2.3200	2.5000	2.2400	2.4600	2.2400	2.5400	0.8600	0.9200	1.0000
MSPE	0.0865	0.0931	0.0861	0.0989	0.0906	0.0988	0.0866	0.0945	0.0930	0.1028	0.1037	0.0978	0.0974
	Bad Leverage Outlier												
SEN	0.4050	0.3100	0.3550	0.3150	0.3500	0.3100	0.3550	0.3150	0.3200	0.3000	0.8000	0.6000	0.3050
SPE	0.9996	0.9997	0.9988	0.9995	0.9990	0.9995	0.9991	0.9994	0.9994	0.9998	0.9842	0.9926	0.9982
MCC	0.5997	0.5278	0.5144	0.5156	0.5192	0.5182	0.5289	0.5109	0.5002	0.5092	0.5650	0.5986	0.3802
FP	0.2200	0.1400	0.6200	0.2600	0.5200	0.2600	0.4400	0.3000	0.5000	0.2400	7.8600	3.3800	0.9800
FN	2.3800	2.7600	2.5800	2.7400	2.6000	2.7600	2.5800	2.7400	2.7200	2.8000	0.8000	1.4500	2.7800
MSPE	0.0958	0.1068	0.1160	0.1155	0.1137	0.1174	0.1092	0.1097	0.1138	0.1164	0.1251	0.1436	0.1992
	Non-leverage Outlier												
SEN	0.4050	0.3600	0.3800	0.3300	0.3200	0.2550	0.3200	0.2800	0.2700	0.2800	0.7400	0.6000	0.5500
SPE	0.9995	0.9996	0.9996	0.9997	0.9993	0.9997	0.9994	0.9998	0.9992	1.0000	0.9836	0.9984	0.9988
MCC	0.5935	0.5571	0.5773	0.5458	0.5117	0.4660	0.5191	0.5017	0.3860	0.4886	0.5019	0.6108	0.6003
FP	0.2600	0.2200	0.2000	0.1400	0.3400	0.1400	0.3000	0.1200	1.0600	0.2200	8.1200	2.5600	2.7200
FN	2.3800	2.5600	2.4800	2.6800	2.7200	2.9800	2.7200	2.8800	2.9200	2.8800	1.0400	1.5000	1.7800
MSPE	0.0902	0.0945	0.0910	0.0963	0.1071	0.1111	0.1051	0.1032	0.1224	0.1096	0.1127	0.1314	0.1510