1. Appendix

1.1. Data

1.2. Simulation Study

		Test MAE		
Corr	model	g1	g2	g3
0.01	ELN.MAE	**0.034579**	0.036195	**0.035334**
	RF.MAE	0.035459	**0.03542**	0.03554
	NN2.MAE	0.03596	0.036921	0.036305
	NN1.MAE	0.035894	0.036834	0.036335
	NN3.MAE	0.035816	0.036934	0.036471
1	ELN.MSE	**0.034614**	0.036276	**0.035444**
	RF.MAE	0.035916	**0.035643**	0.036053
	NN5.MAE	0.037009	0.03727	0.037413
	NN4.MSE	0.037382	0.036897	0.037354
	NN3.MAE	0.037285	0.037038	0.037193

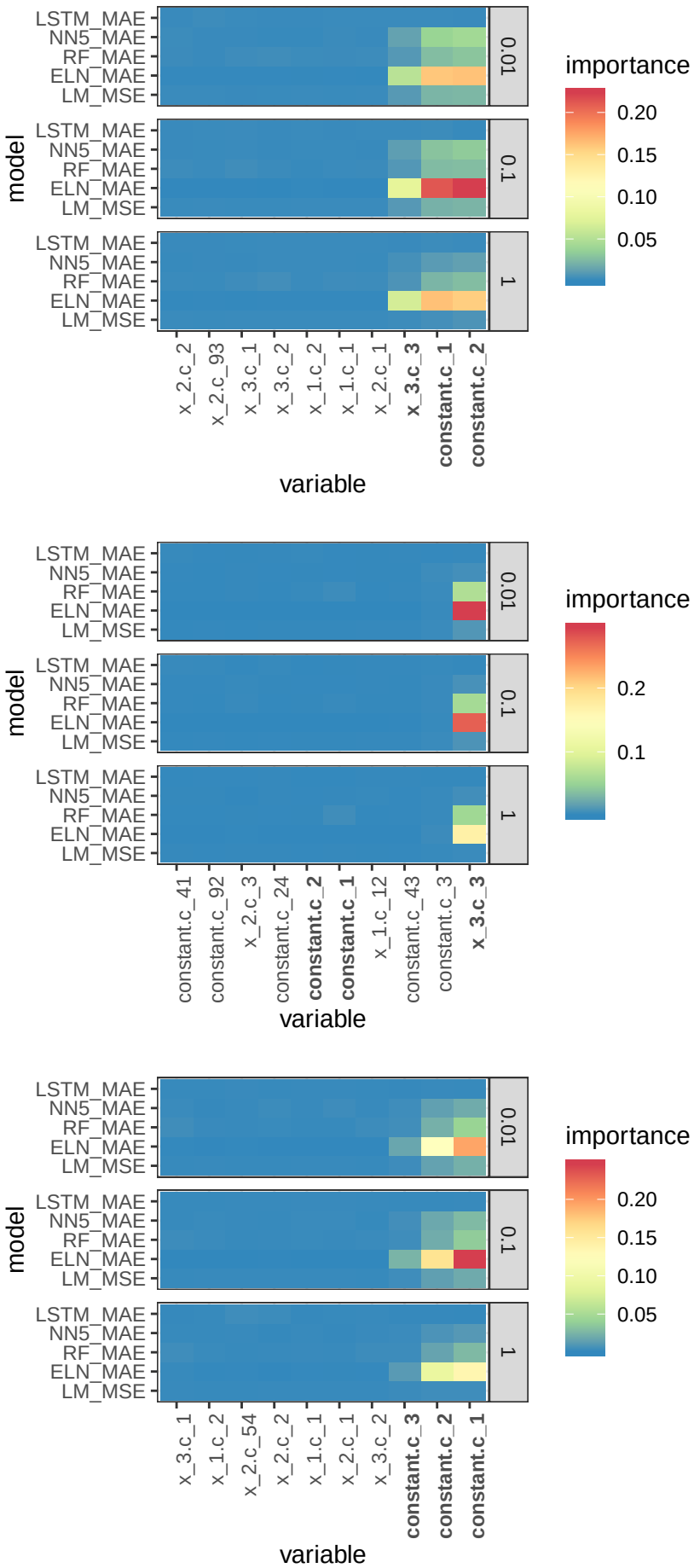
		Test MSE		
Corr	model	g1	g2	g3
0.01	ELN.MAE	**0.002565**	0.002688	**0.002621**
	RF.MAE	0.002643	**0.00263**	0.002645
	NN2.MAE	0.002679	0.002747	0.0027
	NN1.MAE	0.002672	0.00274	0.002703
	NN3.MAE	0.00267	0.002749	0.002718
1	ELN.MSE	**0.002568**	0.002698	**0.00263**
	RF.MAE	0.002675	**0.002644**	0.002679
	NN5.MAE	0.002774	0.002783	0.002792
	NN3.MAE	0.002805	0.002751	0.002797
	NN4.MSE	0.002794	0.002765	0.002775

		g1			g2			g3		
model	Corr	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
LM.MSE	0.01	0.036678	0.002740	0.008273	0.038255	0.002880	-0.111788	0.037310	0.002795	-0.032068
	0.10	0.036965	0.002765	-0.011020	0.038580	0.002914	-0.142944	0.037569	0.002817	-0.054940
	1.00	0.042949	0.003414	-0.438797	0.045376	0.003717	-0.780953	0.043434	0.003469	-0.488779
LM.MAE	0.01	0.036642	0.002737	0.009050	0.038348	0.002886	-0.116369	0.037324	0.002797	-0.035162
	0.10	0.036811	0.002755	0.002919	0.038745	0.002927	-0.152580	0.037489	0.002810	-0.047675
	1.00	0.042340	0.003344	-0.393044	0.045342	0.003685	-0.769955	0.043535	0.003468	-0.544524
ELN.MSE	0.01	0.034588	0.002566	0.140335	0.036223	0.002690	0.036877	0.035353	0.002623	0.099142
	0.10	0.034563	0.002564	0.144238	0.036183	0.002686	0.037258	0.035292	0.002617	0.100241
	1.00	0.034614	0.002568	0.167184	0.036276	0.002698	0.037839	0.035444	0.002630	0.119875
ELN.MAE	0.01	0.034579	0.002565	0.140982	0.036195	0.002688	0.039169	0.035334	0.002621	0.100442
	0.10	0.034558	0.002564	0.144627	0.036173	0.002688	0.038875	0.035285	0.002617	0.100919
	1.00	0.034599	0.002567	0.167771	0.036305	0.002703	0.036583	0.035465	0.002631	0.118022
RF.MSE	0.01	0.035775	0.002671	0.063426	0.035718	0.002657	0.067615	0.035803	0.002661	0.070298
	0.10	0.035769	0.002665	0.066738	0.035684	0.002652	0.069139	0.035867	0.002670	0.062839
	1.00	0.036233	0.002698	0.068774	0.035989	0.002683	0.057103	0.036213	0.002695	0.069887
RF.MAE	0.01	0.035459	0.002643	0.083338	0.035420	0.002630	0.087653	0.035540	0.002645	0.086529
	0.10	0.035515	0.002649	0.081425	0.035489	0.002634	0.083405	0.035569	0.002644	0.081643
	1.00	0.035916	0.002675	0.087081	0.035643	0.002644	0.080965	0.036053	0.002679	0.075357
NN1.MSE	0.01	0.036452	0.002722	0.016344	0.036768	0.002732	-0.003917	0.036687	0.002738	0.009335
	0.10	0.036462	0.002719	0.020422	0.036776	0.002734	-0.007259	0.036733	0.002737	0.002955
	1.00	0.037545	0.002821	-0.014452	0.037049	0.002764	-0.014697	0.037459	0.002798	-0.012469
NN1.MAE	0.01	0.035960	0.002679	0.055814	0.036921	0.002747	-0.015105	0.036305	0.002700	0.039371
	0.10	0.036082	0.002687	0.050698	0.037010	0.002750	-0.020562	0.036322	0.002702	0.032303
	1.00	0.037889	0.002834	-0.043182	0.037979	0.002845	-0.084075	0.037306	0.002793	0.002178
NN2.MSE	0.01	0.037019	0.002785	-0.021787	0.037320	0.002775	-0.043354	0.037089	0.002774	-0.017304
	0.10	0.036977	0.002765	-0.021276	0.037009	0.002748	-0.027538	0.036990	0.002758	-0.020645
	1.00	0.037536	0.002814	-0.013978	0.036903	0.002752	-0.005866	0.037516	0.002809	-0.016934
NN2.MAE	0.01	0.035894	0.002672	0.057743	0.036834	0.002740	-0.007158	0.036335	0.002703	0.036305
	0.10	0.035890	0.002668	0.060310	0.036937	0.002750	-0.017077	0.036270	0.002696	0.037157
	1.00	0.037480	0.002814	-0.009529	0.037715	0.002823	-0.065390	0.037471	0.002804	-0.010118
NN3.MSE	0.01	0.036783	0.002757	-0.006762	0.036840	0.002738	-0.007525	0.037036	0.002764	-0.020078
	0.10	0.036938	0.002761	-0.015399	0.036852	0.002738	-0.015106	0.036874	0.002757	-0.004406
	1.00	0.037424	0.002808	-0.012964	0.036938	0.002754	-0.006353	0.037420	0.002799	-0.010348
NN3.MAE	0.01	0.035816	0.002670	0.065432	0.036934	0.002749	-0.016398	0.036471	0.002718	0.029948
	0.10	0.035893	0.002677	0.062002	0.036859	0.002741	-0.011850	0.036200	0.002693	0.040611
	1.00	0.037009	0.002774	0.021329	0.037270	0.002783	-0.029644	0.037413	0.002792	-0.008307
NN4.MSE	0.01	0.036881	0.002759	-0.020620	0.036856	0.002742	-0.007715	0.037126	0.002775	-0.026563
	0.10	0.036877	0.002761	-0.014579	0.037221	0.002762	-0.048711	0.036872	0.002748	-0.008894
	1.00	0.037382	0.002805	-0.006481	0.036897	0.002751	-0.005369	0.037354	0.002797	-0.007739
NN4.MAE	0.01	0.035935	0.002678	0.057720	0.036897	0.002749	-0.010917	0.036708	0.002738	0.007046
	0.10	0.035828	0.002665	0.065041	0.036933	0.002749	-0.019112	0.036273	0.002695	0.037704
	1.00	0.037095	0.002779	0.019866	0.037323	0.002795	-0.029377	0.037301	0.002787	-0.001888

		g1			g2			g3		
model	Corr	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
NN5.MSE	0.01	0.037231	0.002785	-0.049970	0.036931	0.002747	-0.017002	0.037114	0.002772	-0.021895
	0.10	0.037026	0.002767	-0.032190	0.037176	0.002762	-0.039436	0.036909	0.002757	-0.011352
	1.00	0.037364	0.002795	-0.010495	0.036928	0.002755	-0.005376	0.037475	0.002807	-0.014974
NN5.MAE	0.01	0.035888	0.002669	0.058579	0.036835	0.002738	-0.008646	0.036685	0.002737	0.004643
	0.10	0.036038	0.002680	0.050976	0.036745	0.002727	-0.004935	0.036484	0.002710	0.018192
	1.00	0.037285	0.002794	0.002541	0.037038	0.002765	-0.012729	0.037193	0.002775	0.002572
LSTM.MSE	0.01	0.037296	0.002798	-0.043289	0.037227	0.002776	-0.044764	0.037591	0.002818	-0.062516
	0.10	0.037237	0.002795	-0.031955	0.037134	0.002767	-0.038255	0.037198	0.002785	-0.030394
	1.00	0.038128	0.002851	-0.082027	0.037382	0.002792	-0.044243	0.037780	0.002830	-0.044330
LSTM.MAE	0.01	0.037431	0.002805	-0.056406	0.037337	0.002780	-0.051854	0.037627	0.002817	-0.067433
	0.10	0.037446	0.002804	-0.062952	0.037118	0.002768	-0.032544	0.037241	0.002793	-0.033320
	1.00	0.038027	0.002846	-0.061483	0.037415	0.002790	-0.045506	0.037743	0.002825	-0.045884
FFORMA.MSE	0.01	0.038277	0.002882	-0.132672	0.038460	0.002889	-0.147390	0.042466	0.003311	-0.486145
	0.10	0.038358	0.002895	-0.140765	0.038479	0.002891	-0.160062	0.042323	0.003291	-0.473991
	1.00	0.038875	0.002965	-0.131239	0.038808	0.002933	-0.165990	0.043013	0.003371	-0.470954
FFORMA.MAE	0.01	0.038755	0.002939	-0.179748	0.038747	0.002918	-0.174094	0.042989	0.003365	-0.527909
	0.10	0.038936	0.002951	-0.192793	0.038796	0.002946	-0.175994	0.043097	0.003406	-0.586375
	1.00	0.039247	0.002972	-0.163656	0.039387	0.002996	-0.211619	0.043709	0.003448	-0.526081
DeepAR	0.01	0.038299	0.002900	-0.128930	0.038489	0.002912	-0.132518	0.039390	0.003016	-0.204980
	0.10	0.038832	0.002935	-0.181663	0.038435	0.002905	-0.131874	0.039177	0.002993	-0.190558
	1.00	0.040535	0.003159	-0.239142	0.038787	0.002952	-0.144029	0.039692	0.003042	-0.182365

1.2.1. Empirical Study

	Sample 1			Sample 2			Sample 2		
model	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
LM.MSE	0.125789	0.033978	0.177466	0.192214	0.063759	-0.494794	0.153725	0.052142	-0.152455
LM.MAE	0.131564	0.035982	0.128962	0.195059	0.068043	-0.595218	0.162192	0.055276	-0.221724
ELN.MSE	0.113368	0.030077	0.271905	0.109012	0.028236	0.338017	0.108880	0.028704	0.365584
ELN.MAE	0.112670	0.029925	0.275570	0.108476	0.028110	0.340980	0.108386	0.028540	0.369194
RF.MSE	0.114529	0.030262	0.267418	0.127399	0.034085	0.200911	0.116459	0.031467	0.304521
RF.MAE	0.112992	0.029667	0.281832	0.116508	0.030331	0.288907	0.110902	0.029194	0.354753
NN1.MSE	0.131819	0.037302	0.097002	0.148036	0.043259	-0.014169	0.153932	0.049144	-0.086188
NN1.MAE	0.125764	0.035076	0.150879	0.137917	0.038843	0.089365	0.131550	0.036636	0.190256
NN2.MSE	0.143568	0.040980	0.007970	0.135490	0.037294	0.125664	0.138839	0.040496	0.104959
NN2.MAE	0.122177	0.033544	0.187965	0.149905	0.042581	0.001722	0.129366	0.035951	0.205403
NN3.MSE	0.149127	0.043549	-0.054235	0.170421	0.055281	-0.296023	0.156663	0.052492	-0.160178
NN3.MAE	0.125652	0.034758	0.158588	0.133937	0.036296	0.149068	0.131814	0.037397	0.173441
NN4.MSE	0.131382	0.036754	0.110256	0.150690	0.044790	-0.050066	0.133198	0.040856	0.096985
NN4.MAE	0.124549	0.034394	0.167397	0.129129	0.035406	0.169931	0.127675	0.036107	0.201965
NN5.MSE	0.137242	0.040688	0.015038	0.122725	0.033852	0.206371	0.146881	0.047384	-0.047284
NN5.MAE	0.124490	0.033774	0.182414	0.119715	0.032193	0.245261	0.134711	0.038343	0.152531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NN5_MAE
RF_MAE
ELN_MAE
LM_MSE
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x_3.c_2
x_1.c_2
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x_2.c_1
x_3.c_3
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constant.c_2
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constant.c_1
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constant.c_43
constant.c_3
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0.1
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x_1.c_2
x_2.c_54
x_2.c_2
x_1.c_1
x_2.c_1
x_3.c_2
constant.c_3
constant.c_2
constant.c_1

Figure 1. g1 BC VIMP

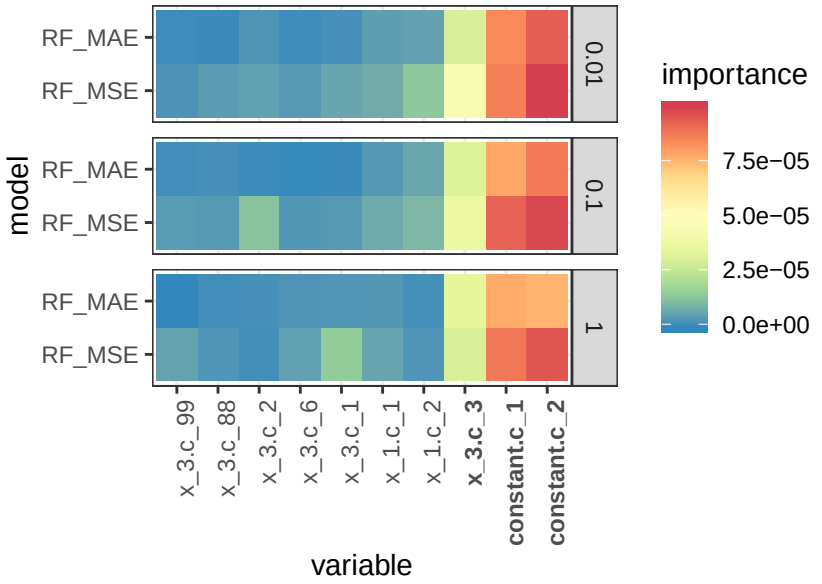


Figure 2. g2 BC VIMP

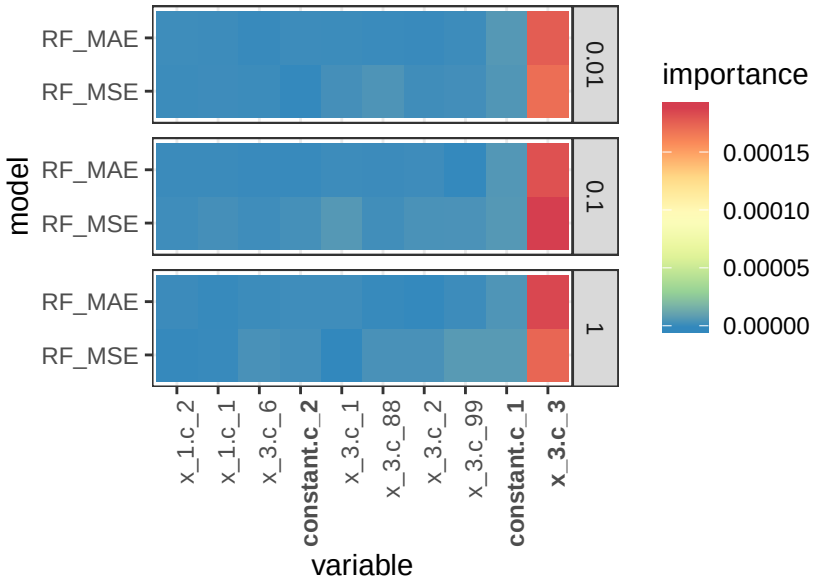


Figure 3. g3 BC VIMP

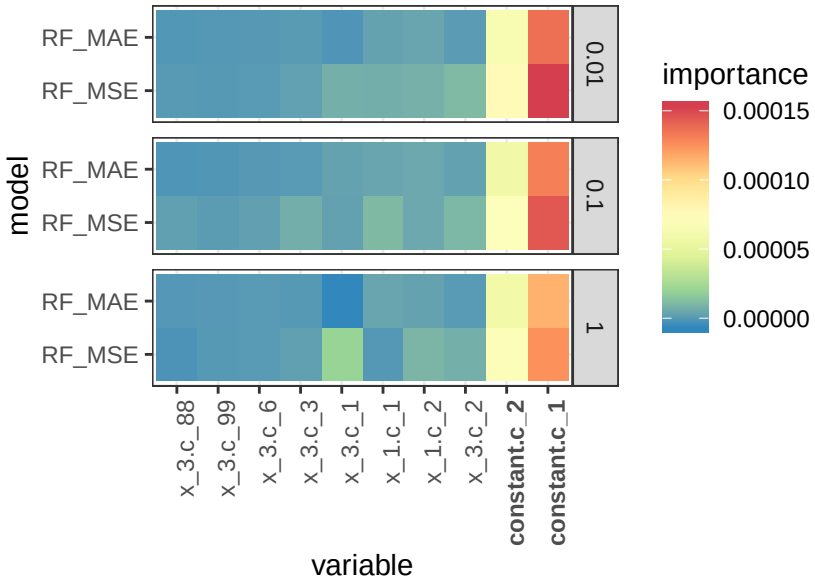


Figure 4. g1 IK VIMP

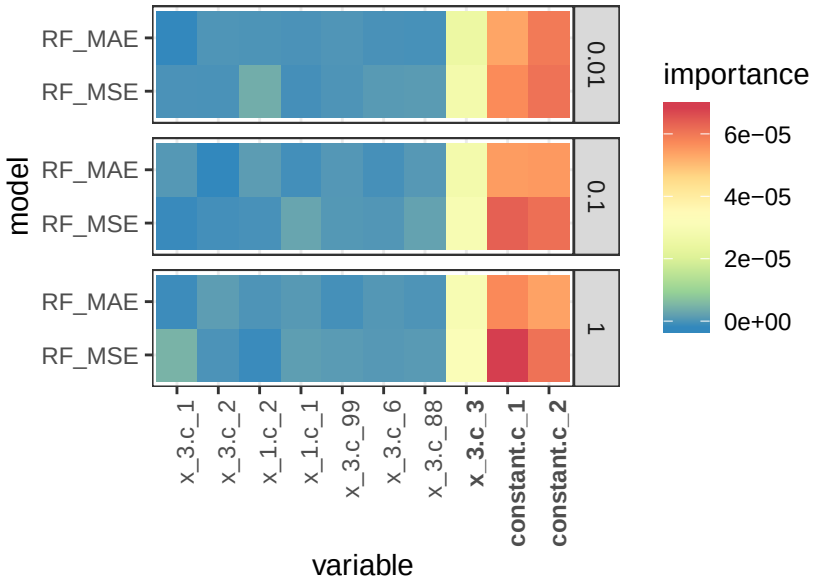


Figure 5. g2 IK VIMP

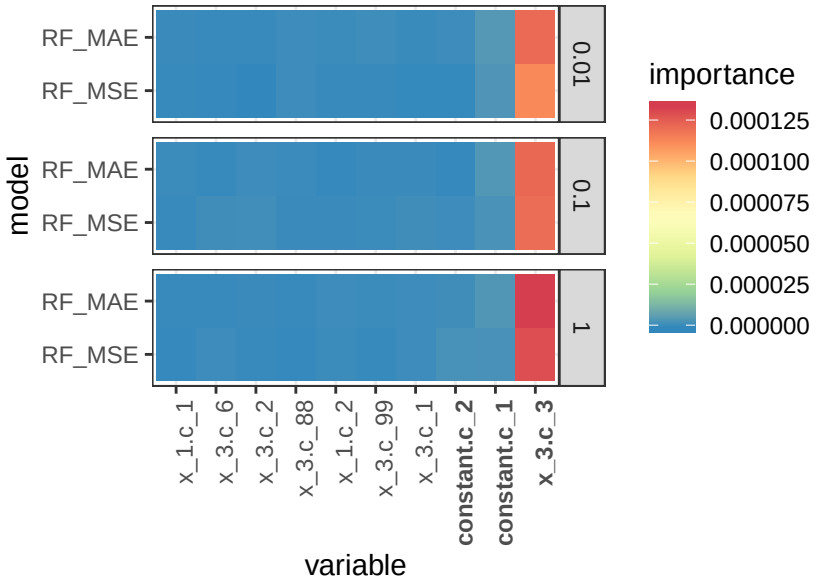
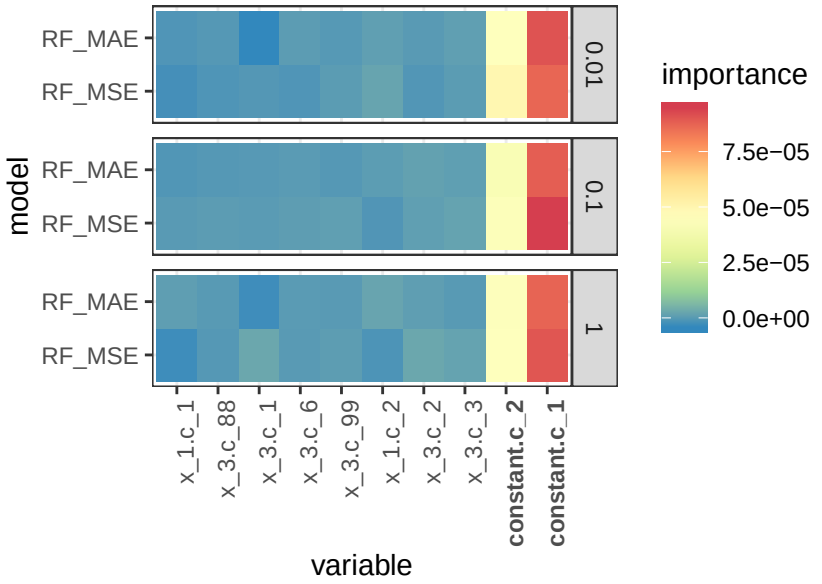


Figure 6. g3 IK VIMP



1.3. Empirical Robustness Checks

1.3.1. Missing Data Threshold Robustness Check

1.3.2. Train:Validation = 1:1 Robustness Check

	Sample 1			Sample 2			Sample 3		
model	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
LM.MSE	0.915703	2.495094	-59.401029	0.717	1.553454	-35.419641	0.451206	0.375505	-7.299459
LM.MAE	0.751551	1.583265	-37.32754	0.469831	0.524686	-11.300895	0.675112	1.105759	-23.43964
ELN.MSE	0.134609	**0.040072**	**0.029933**	0.141434	0.043169	-0.012055	**0.144375**	**0.043705**	**0.034019**
ELN.MAE	**0.131668**	0.040748	0.013583	**0.137494**	**0.042135**	**0.012178**	0.146776	0.045753	-0.01123
RF.MSE	0.155282	0.046655	-0.129427	0.210936	0.078006	-0.828784	0.229147	0.092622	-1.047155
RF.MAE	0.13882	0.04016	0.027805	0.185338	0.063217	-0.482087	0.182753	0.063873	-0.411736
NN1.MSE	0.218129	0.087699	-1.123002	0.238606	0.110201	-1.583582	0.260721	0.120908	-1.672321
NN1.MAE	0.202259	0.072844	-0.763409	0.205092	0.073567	-0.724721	0.239051	0.096477	-1.132346
NN2.MSE	0.239446	0.101312	-1.452556	0.206109	0.078412	-0.838305	0.228591	0.095126	-1.102488
NN2.MAE	0.19141	0.068261	-0.652455	0.184095	0.062366	-0.462125	0.220087	0.086888	-0.920403
NN3.MSE	0.193117	0.069206	-0.675336	0.193859	0.070747	-0.658609	0.205093	0.076497	-0.690745
NN3.MAE	0.191596	0.066926	-0.620138	0.176555	0.060022	-0.407183	0.234768	0.091003	-1.011359
NN4.MSE	0.191361	0.07068	-0.71101	0.175311	0.059253	-0.389136	0.18148	0.061718	-0.364096
NN4.MAE	0.139659	0.041096	0.005158	0.179318	0.05976	-0.401027	0.188921	0.066144	-0.461932
NN5.MSE	0.17209	0.056982	-0.379418	0.164756	0.054398	-0.275325	0.202012	0.074051	-0.636691
NN5.MAE	0.170945	0.056029	-0.356356	0.180669	0.059697	-0.399552	0.189149	0.065921	-0.456988

Figure 7. Fama French Factors Robustness Check Indiviudal Factor Importance

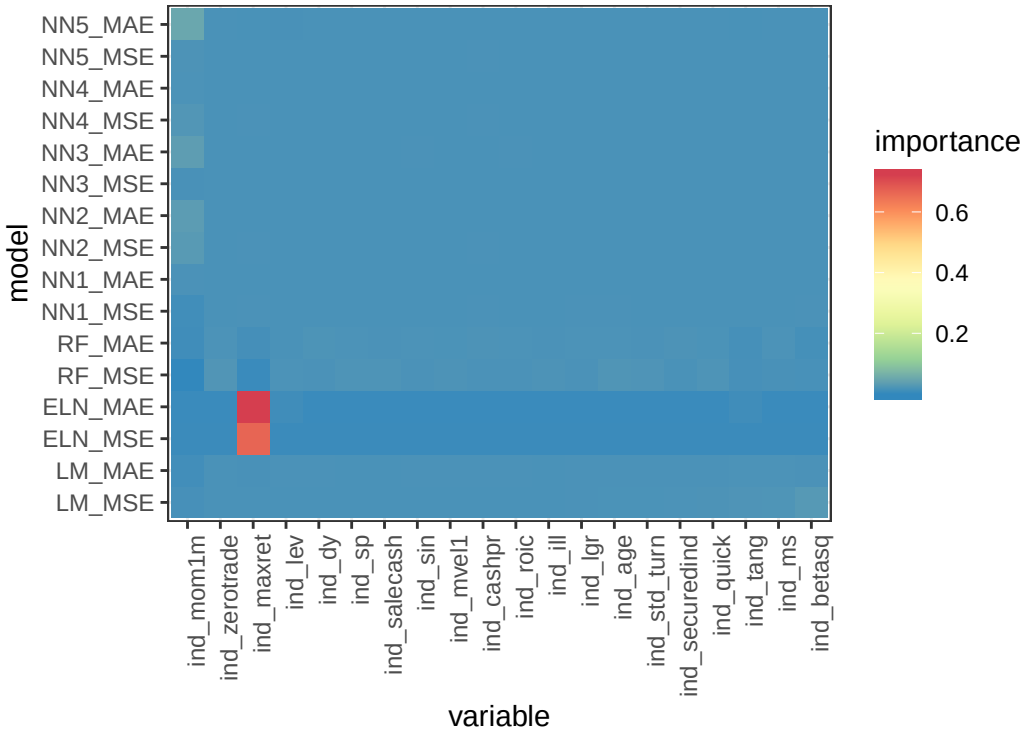


Figure 8. Fama French Factors Robustness Check Macroeconomic Factor Importance

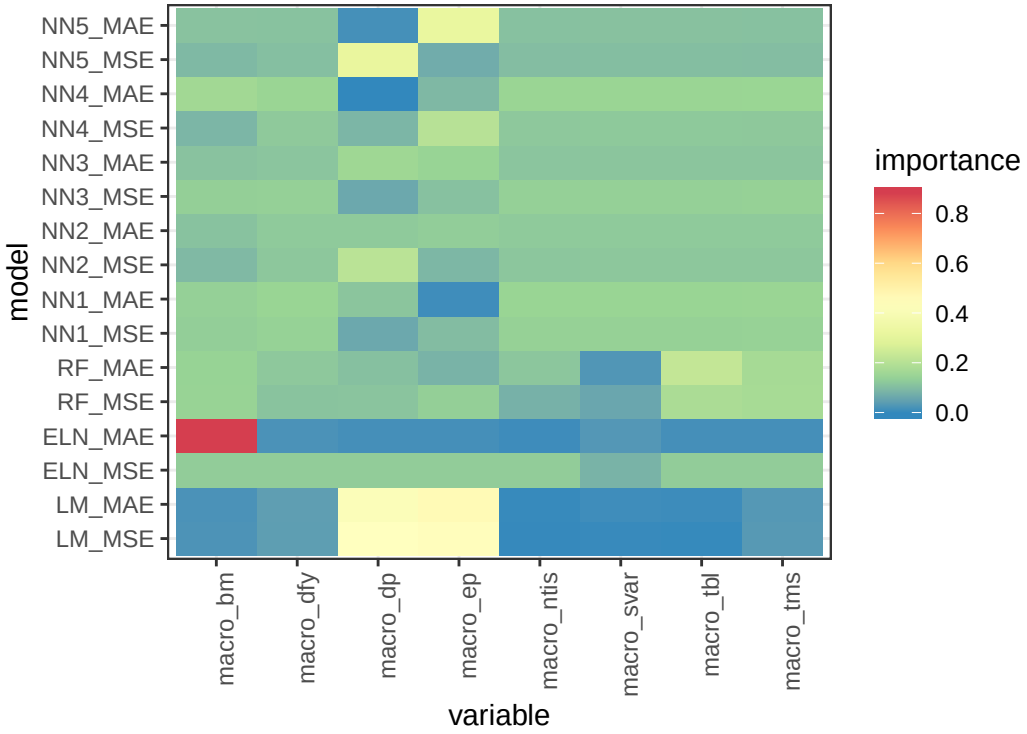
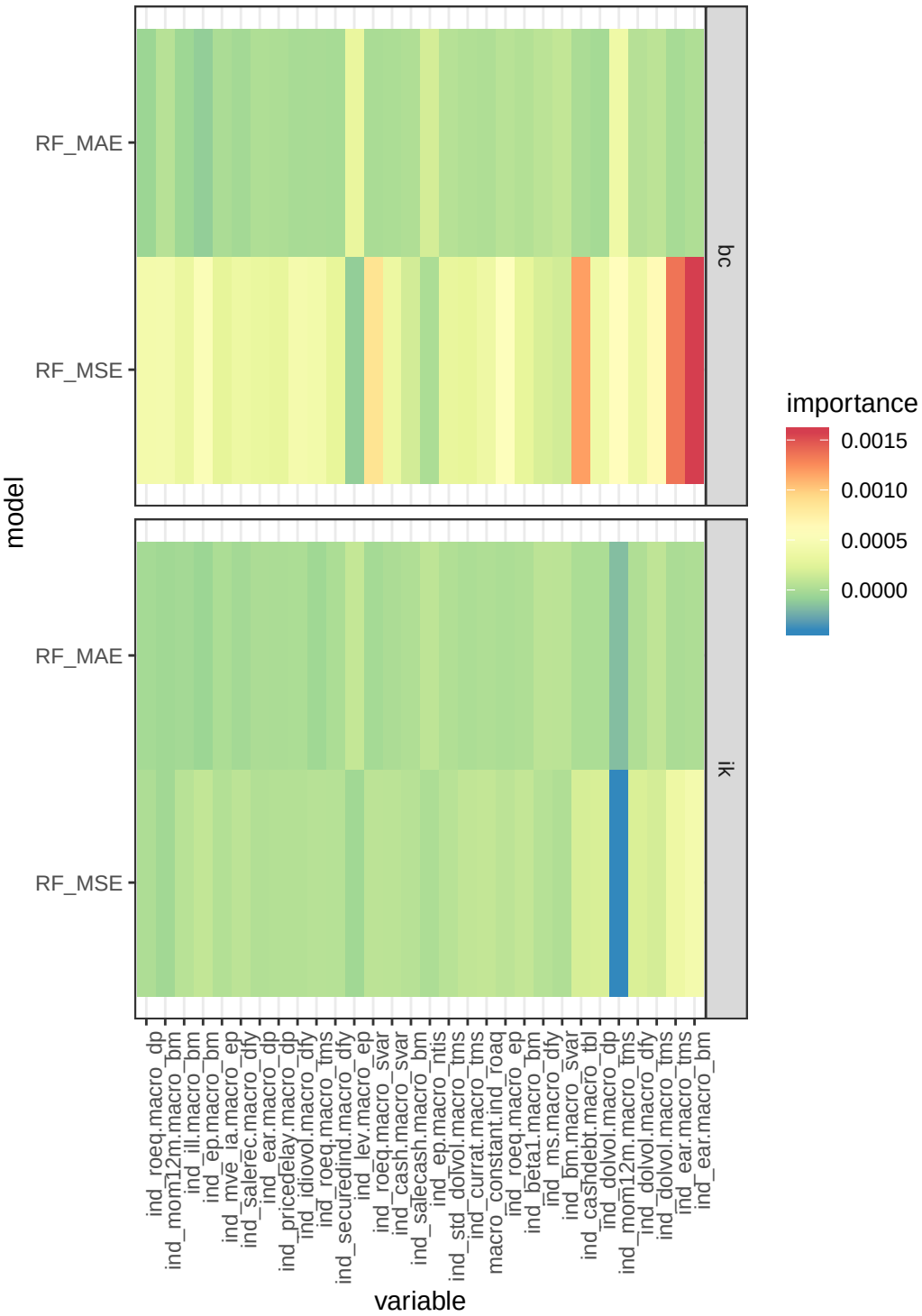


Figure 9. Fama French Factors Robustness Check RF VIMP



1.3.3. Train:Validation = 2:1 Robustness Check

	Sample 1			Sample 2			Sample 3		
model	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
LM.MSE	0.277087	0.164599	-2.98459	0.383421	0.31299	-6.337839	0.523418	0.740288	-15.361936
LM.MAE	0.246936	0.147979	-2.582262	0.277044	0.161215	-2.779579	0.487285	0.631575	-12.95915
ELN.MSE	0.133715	0.039919	0.033647	0.139723	0.042525	0.003028	**0.145034**	**0.044306**	**0.020752**
ELN.MAE	0.131237	0.04035	0.023214	**0.137243**	**0.041866**	**0.01849**	0.174423	0.064157	-0.418013
RF.MSE	0.130808	0.036982	0.104754	0.162762	0.051118	-0.198417	0.155264	0.048661	-0.075516
RF.MAE	**0.127013**	**0.036722**	**0.111033**	0.146758	0.043961	-0.030633	0.168905	0.055983	-0.237348
NN1.MSE	0.155088	0.050284	-0.217281	0.165871	0.053459	-0.253309	0.181984	0.064621	-0.428262
NN1.MAE	0.159797	0.050566	-0.224107	0.163397	0.052329	-0.226828	0.181636	0.062407	-0.379326
NN2.MSE	0.155815	0.050954	-0.233492	0.168576	0.055738	-0.306745	0.170991	0.057453	-0.269824
NN2.MAE	0.148149	0.047617	-0.152709	0.166334	0.054058	-0.26734	0.163141	0.052639	-0.163436
NN3.MSE	0.154141	0.04976	-0.204586	0.166218	0.053402	-0.251967	0.169539	0.05661	-0.251204
NN3.MAE	0.142464	0.043771	-0.059594	0.154233	0.048682	-0.141321	0.184217	0.064175	-0.418401
NN4.MSE	0.166547	0.056184	-0.360092	0.150748	0.047566	-0.115162	0.168447	0.056575	-0.250437
NN4.MAE	0.150167	0.046919	-0.135802	0.16197	0.05226	-0.225199	0.171676	0.057352	-0.267598
NN5.MSE	0.155784	0.052258	-0.265047	0.139699	0.043082	-0.010018	0.166166	0.055027	-0.216219
NN5.MAE	0.161161	0.053216	-0.28825	0.149207	0.046344	-0.086511	0.149424	0.047544	-0.050824

Figure 10. Fama French Factors Robustness Check Indiviudal Factor Importance

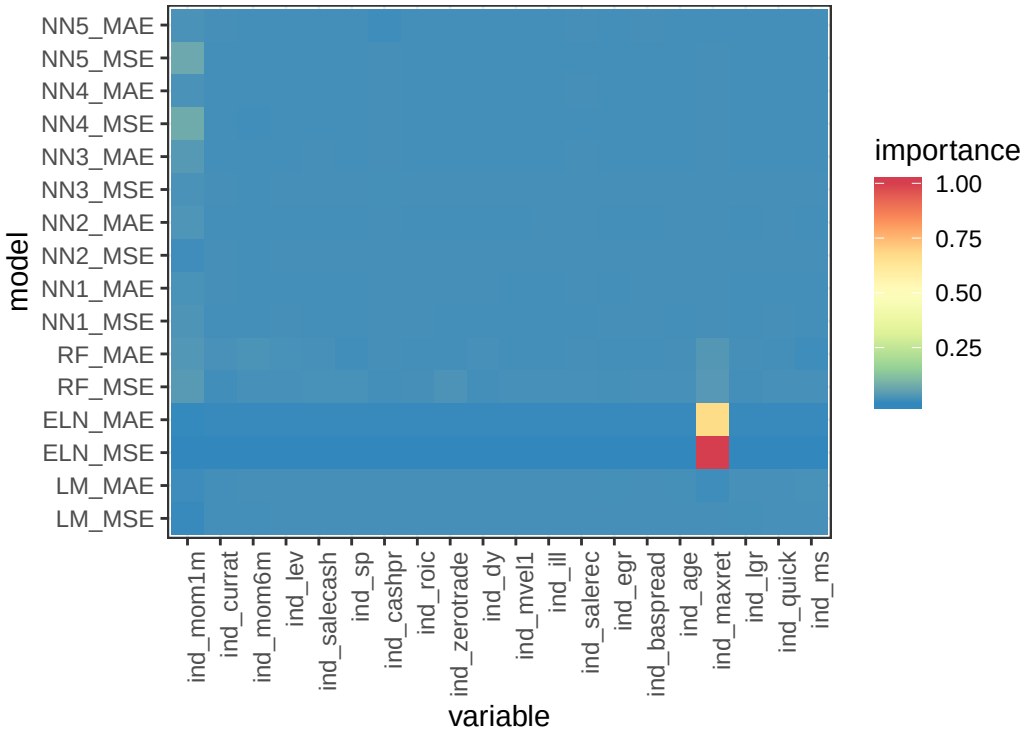


Figure 11. Fama French Factors Robustness Check Macroeconomic Factor Importance

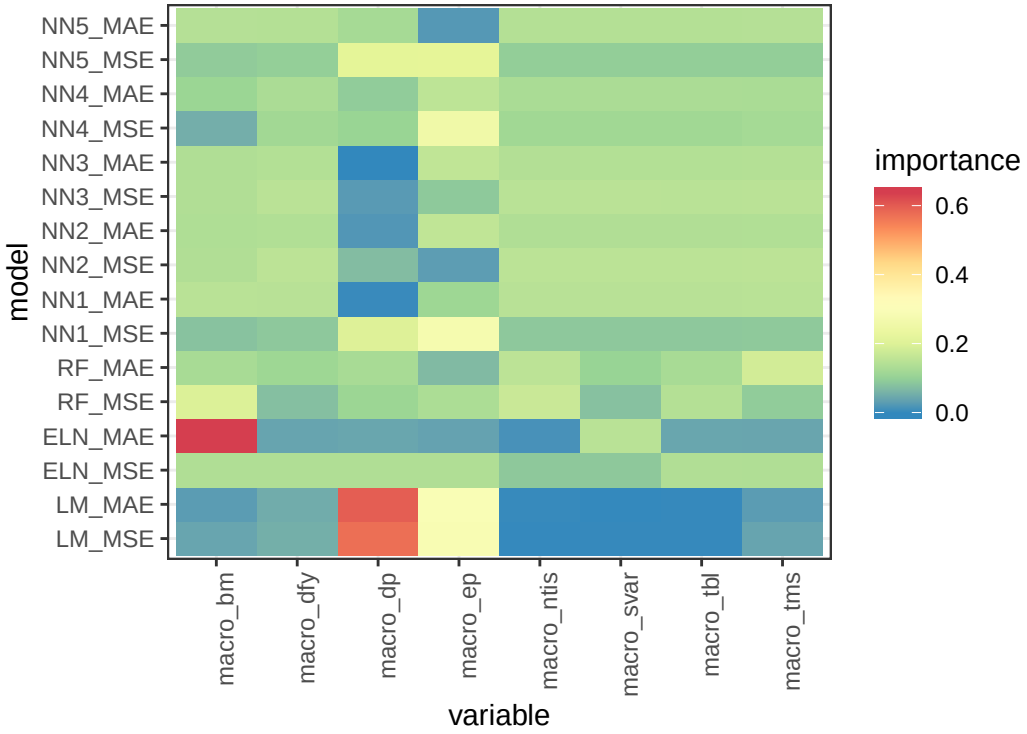
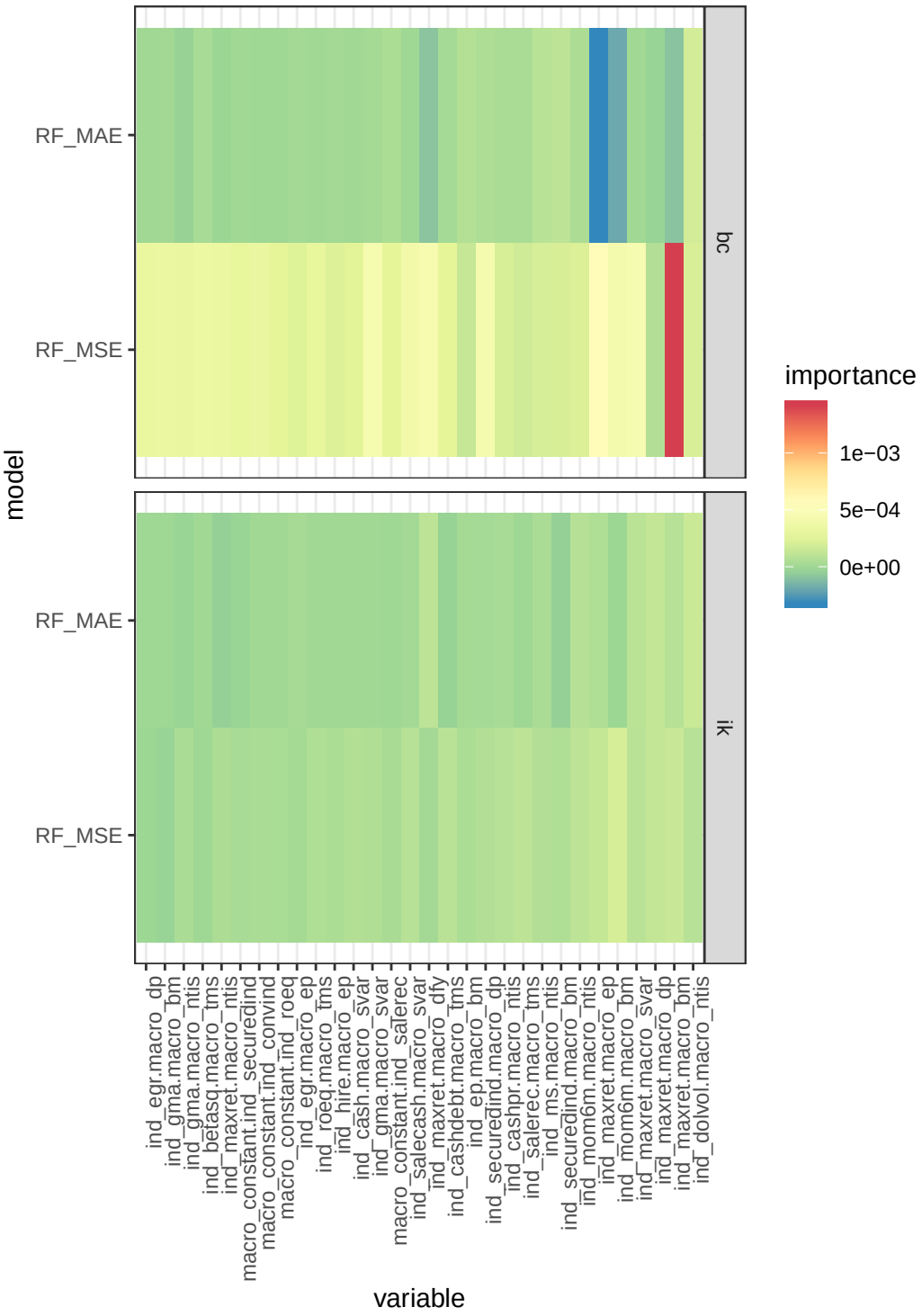


Figure 12. Fama French Factors Robustness Check RF VIMP



1.3.4. Fama French Factors Robustness Check

	Sample 1			Sample 2			Sample 3		
model	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2	Test MAE	Test MSE	Test R^2
LM.MSE	0.288636	0.182966	-3.42923	0.367636	0.264918	-5.210825	1.101604	5.012469	-109.78624
LM.MAE	0.280525	0.179758	-3.351576	0.376144	0.279439	-5.551243	1.253431	7.06053	-155.052759
ELN.MSE	0.13383	0.039956	0.032746	0.14022	0.0427	-0.00107	**0.144472**	**0.043852**	**0.030767**
ELN.MAE	**0.128918**	**0.039642**	**0.040343**	**0.137159**	0.042143	0.011995	0.172303	0.063311	-0.399298
RF.MSE	0.144879	0.041758	-0.010873	0.147762	0.044798	-0.050264	0.177274	0.067773	-0.497936
RF.MAE	0.138597	0.040075	0.029879	0.138147	**0.041666**	**0.023169**	0.151722	0.047505	-0.049957
NN1.MSE	0.1661	0.054234	-0.312891	0.205285	0.074741	-0.752262	0.253476	0.116418	-1.573091
NN1.MAE	0.158072	0.048638	-0.177434	0.194348	0.064834	-0.519993	0.224166	0.087287	-0.92922
NN2.MSE	0.170655	0.058042	-0.405072	0.207143	0.076048	-0.782885	0.267126	0.12498	-1.762332
NN2.MAE	0.155235	0.050055	-0.211735	0.18464	0.060654	-0.421978	0.204125	0.074356	-0.643421
NN3.MSE	0.16589	0.051463	-0.245815	0.1975	0.070273	-0.647508	0.229404	0.095177	-1.103613
NN3.MAE	0.146644	0.043668	-0.0571	0.196677	0.065247	-0.529679	0.199122	0.072357	-0.599233
NN4.MSE	0.158661	0.05119	-0.23921	0.185323	0.063435	-0.487199	0.242946	0.107016	-1.365279
NN4.MAE	0.141087	0.042652	-0.032513	0.195637	0.066517	-0.559455	0.195462	0.068823	-0.521137
NN5.MSE	0.166067	0.055251	-0.337508	0.160318	0.049854	-0.168795	0.20613	0.078971	-0.745421
NN5.MAE	0.141029	0.041439	-0.003147	0.153325	0.04766	-0.117345	0.191643	0.068886	-0.522526

References

Figure 13. Fama French Factors Robustness Check Indiviudal Factor Importance

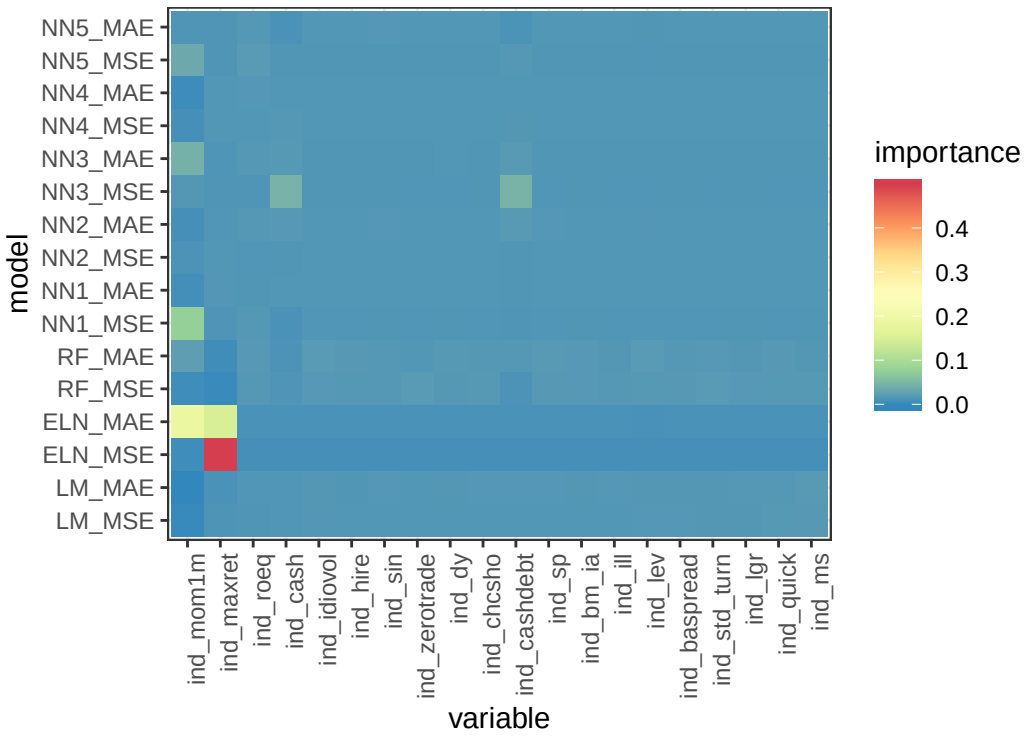


Figure 14. Fama French Factors Robustness Check Macroeconomic Factor Importance

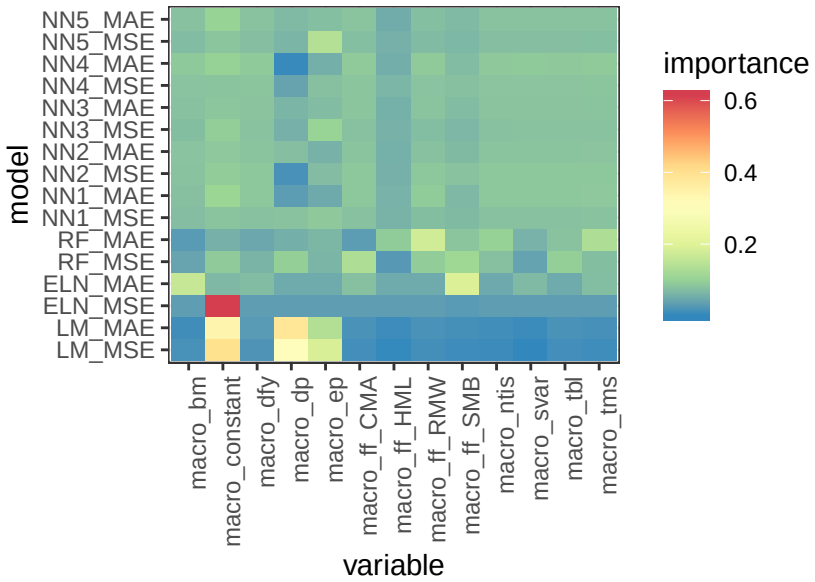


Figure 15. Fama French Factors Robustness Check RF VIMP