Appendix
A Model-Agnostic Framework to Stabilise Forecasts

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Appendix A.

Tables A.1 and A.2 respectively show the MAE and RMSE based accuracy and stability results of vertical stability experiments across the four experimental datasets. The best performing models in each group are italicized and the overall best performing models are highlighted in boldface.

Table A.1: MAE, MAC and MAC_I results of vertical stability experiments.

	MAE				MAC				MAC_I			
	M4	M3	Favorita	M5	M4	M3	Favorita	M5	M4	M3	Favorita	M5
NBEATS												
Base	394.718	499.275	-	-	194.963	176.017	-	-	267.808	264.625	-	-
Stable	***394.533***	**497.189**	-	-	***135.807***	***127.870***	-	-	***215.746***	***218.174***	-	-
PI_0.2	***393.223***	***498.985***	-	-	154.345	143.009	-	-	243.425	241.940	-	-
PI_0.4	395.551	500.783	-	-	125.200	119.618	-	-	222.384	221.859	-	-
PI_0.5	398.032	502.488	-	-	117.431	113.207	-	-	213.275	212.978	-	-
PI_0.6	401.337	504.766	-	-	***115.009***	***110.552***	-	-	205.179	204.958	-	-
PI_0.8	410.212	510.865	-	-	122.976	115.426	-	-	192.234	191.643	-	-
PI_1	421.904	518.937	-	-	142.060	129.416	-	-	***184.004***	***182.078***	-	-
FI_0.2	**393.083**	***498.754***	-	-	153.933	141.939	-	-	240.123	238.484	-	-
FI_0.4	395.318	500.083	-	-	117.361	110.515	-	-	206.070	205.272	-	-
FI_0.5	398.268	501.735	-	-	99.880	95.028	-	-	185.108	184.501	-	-
FI_0.6	402.942	504.403	-	-	82.455	79.241	-	-	160.437	159.951	-	-
FI_0.8	420.442	515.446	-	-	45.610	44.596	-	-	95.543	95.204	-	-
FI_1	457.857	543.402	-	-	**0.000**	**0.000**	-	-	**0.000**	**0.000**	-	-
PR												
Base	**457.977**	**563.163**	***2.426***	***5.321***	***140.825***	***149.688***	***0.488***	***1.380***	***226.883***	***214.089***	***0.582***	***2.313***
PI_0.2	***461.139***	***564.716***	2.420	***5.307***	118.160	122.679	0.385	1.087	206.587	192.797	0.516	2.170
PI_0.4	465.625	567.470	***2.418***	5.309	100.483	101.600	0.300	0.886	187.984	173.695	0.457	2.051
PI_0.5	468.365	569.337	2.418	5.316	94.886	94.595	0.273	0.838	179.441	165.173	0.430	2.002
PI_0.6	471.423	571.504	2.419	5.327	91.618	***90.774***	***0.258***	***0.828***	171.496	157.492	0.407	1.961
PI_0.8	478.462	576.747	2.424	5.361	***91.057***	91.773	0.259	0.916	157.606	144.683	0.371	1.903
PI_1	486.762	583.228	2.433	5.411	97.218	101.305	0.296	1.111	***146.788***	***135.799***	***0.353***	***1.882***
FI_0.2	***461.411***	***564.888***	2.420	5.306	117.078	121.870	0.385	1.085	203.611	190.000	0.509	2.150
FI_0.4	467.156	568.434	2.416	**5.302**	93.363	95.116	0.289	0.827	173.984	160.487	0.425	1.949
FI_0.5	471.254	571.167	**2.416**	5.305	81.010	81.645	0.243	0.707	155.681	142.773	0.376	1.819
FI_0.6	476.517	574.778	2.417	5.312	68.023	67.790	0.197	0.588	134.273	122.417	0.321	1.656
FI_0.8	492.500	585.843	2.426	5.350	38.506	37.389	0.105	0.339	78.967	71.171	0.185	1.138
FI_1	521.661	605.974	2.450	5.555	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
LightGBM												
Base	**473.849**	**562.678**	**2.567**	**5.161**	***157.665***	***166.004***	***0.404***	***1.010***	***236.394***	***235.818***	***0.555***	***1.954***
PI_0.2	***476.197***	***563.759***	***2.569***	***5.162***	129.560	134.229	0.326	0.816	214.520	213.439	0.498	1.846
PI_0.4	480.547	566.600	2.574	5.173	107.616	110.056	0.264	0.683	194.997	193.827	0.446	1.753
PI_0.5	483.462	568.729	2.577	5.181	100.506	102.519	0.243	0.651	186.180	185.167	0.424	1.712
PI_0.6	486.851	571.299	2.580	5.191	***97.267***	***99.269***	***0.231***	***0.646***	178.056	177.283	0.403	1.676
PI_0.8	494.957	577.710	2.588	5.219	99.323	103.287	0.231	0.698	164.162	164.068	0.368	1.617
PI_1	504.699	585.668	2.598	5.255	109.686	116.230	0.255	0.815	***154.010***	***154.979***	***0.344***	***1.582***
FI_0.2	***476.490***	***563.914***	***2.570***	***5.162***	128.718	133.562	0.325	0.811	211.512	210.449	0.491	1.829
FI_0.4	482.156	567.590	2.576	5.170	101.109	103.556	0.251	0.635	180.597	179.382	0.415	1.667
FI_0.5	486.525	570.662	2.581	5.177	87.103	88.687	0.214	0.550	161.633	160.481	0.370	1.559
FI_0.6	492.314	574.868	2.587	5.187	72.597	73.527	0.177	0.465	139.485	138.453	0.318	1.421
FI_0.8	510.365	588.532	2.605	5.224	40.508	40.670	0.097	0.277	82.205	81.592	0.187	0.977
FI_1	543.550	615.660	2.638	5.384	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Table A.2: RMSE, RMSC and RMSC_I results of vertical stability experiments.

	RMSE				RMSC				RMSC_I			
	M4	M3	Favorita	M5	M4	M3	Favorita	M5	M4	M3	Favorita	M5
NBEATS												
Base	468.469	591.192	-	-	207.259	184.008	-	-	303.638	298.414	-	-
Stable	***467.117***	**589.290**	-	-	***143.592***	***133.437***	-	-	***244.804***	***247.956***	-	-
PI_0.2	***466.629***	***590.737***	-	-	164.352	150.001	-	-	278.926	276.213	-	-
PI_0.4	468.886	592.655	-	-	134.745	127.173	-	-	258.316	257.125	-	-
PI_0.5	471.446	594.490	-	-	127.210	121.330	-	-	249.871	249.024	-	-
PI_0.6	474.900	596.897	-	-	***125.411***	***119.575***	-	-	242.839	242.063	-	-
PI_0.8	484.297	603.362	-	-	137.951	128.198	-	-	233.547	232.081	-	-
PI_1	496.698	611.882	-	-	167.302	150.487	-	-	***231.533***	***227.968***	-	-
FI_0.2	**466.462**	***590.494***	-	-	163.762	148.708	-	-	275.253	272.360	-	-
FI_0.4	468.537	591.908	-	-	125.545	116.670	-	-	239.726	238.193	-	-
FI_0.5	471.542	593.737	-	-	107.348	100.932	-	-	217.308	216.179	-	-
FI_0.6	476.438	596.740	-	-	89.180	84.803	-	-	190.302	189.442	-	-
FI_0.8	495.616	609.216	-	-	50.263	48.747	-	-	116.140	115.610	-	-
FI_1	539.491	640.988	-	-	**0.000**	**0.000**	-	-	**0.000**	**0.000**	-	-
PR												
Base	**535.777**	**660.323**	***3.125***	***6.587***	***142.305***	***154.168***	***0.520***	***1.442***	***253.578***	***240.909***	***0.659***	***2.603***
PI_0.2	***538.443***	***661.296***	3.119	***6.571***	120.240	127.049	0.412	1.145	233.970	219.884	0.590	2.455
PI_0.4	542.645	663.718	***3.117***	6.572	104.099	106.989	0.325	0.946	216.355	201.406	0.529	2.334
PI_0.5	545.310	665.472	3.117	6.579	99.259	100.812	0.297	0.898	208.467	193.370	0.503	2.285
PI_0.6	548.344	667.587	3.119	6.591	***96.820***	***97.845***	***0.283***	***0.888***	201.309	186.280	0.481	2.246
PI_0.8	555.508	672.886	3.126	6.626	98.749	101.549	0.289	0.980	189.592	175.280	0.448	2.196
PI_1	564.110	679.595	3.137	6.678	109.335	116.020	0.342	1.196	***182.073***	***169.405***	***0.438***	***2.189***
FI_0.2	***538.635***	***661.373***	3.119	6.569	118.971	126.027	0.411	1.141	230.674	216.738	0.582	2.433
FI_0.4	543.872	664.308	**3.116**	**6.564**	96.046	99.335	0.310	0.879	200.485	186.234	0.493	2.223
FI_0.5	547.778	666.745	3.117	6.566	84.082	85.886	0.262	0.755	181.188	167.326	0.440	2.086
FI_0.6	552.949	670.092	3.120	6.572	71.355	71.939	0.214	0.632	157.989	145.044	0.379	1.911
FI_0.8	569.466	681.028	3.133	6.609	41.516	40.663	0.115	0.371	95.253	86.439	0.224	1.338
FI_1	601.941	702.605	3.167	6.830	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
LightGBM												
Base	**551.580**	**660.952**	**3.167**	***6.361***	***165.394***	***179.361***	***0.449***	***1.119***	***268.626***	***270.842***	***0.642***	***2.223***
PI_0.2	***553.317***	***661.483***	**3.167**	***6.359***	136.088	144.799	0.362	0.901	246.445	247.839	0.581	2.107
PI_0.4	557.316	664.123	3.170	6.367	114.446	119.745	0.294	0.757	227.108	228.155	0.527	2.010
PI_0.5	560.140	666.218	3.172	6.375	107.868	112.430	0.272	0.723	218.735	219.828	0.503	1.969
PI_0.6	563.491	668.819	3.175	6.386	***105.050***	***109.769***	***0.260***	***0.717***	211.355	212.661	0.483	1.934
PI_0.8	571.682	675.455	3.183	6.414	110.156	117.674	0.267	0.783	199.997	202.236	0.453	1.883
PI_1	581.709	683.872	3.193	6.453	127.040	138.871	0.308	0.934	***194.016***	***197.775***	***0.437***	***1.863***
FI_0.2	***553.517***	***661.562***	**3.167**	**6.358**	135.107	144.064	0.361	0.896	243.116	244.479	0.573	2.088
FI_0.4	558.560	664.743	3.171	6.362	106.803	111.996	0.279	0.701	210.703	211.490	0.491	1.914
FI_0.5	562.676	667.614	3.175	6.367	92.556	96.287	0.238	0.608	190.304	190.891	0.441	1.799
FI_0.6	568.319	671.696	3.180	6.375	77.782	80.294	0.198	0.514	165.917	166.358	0.382	1.649
FI_0.8	586.933	685.736	3.199	6.406	44.483	45.295	0.109	0.308	100.144	100.401	0.229	1.154
FI_1	624.029	715.230	3.237	6.577	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Tables A.3 and A.4 respectively show the MAE and RMSE based accuracy and stability results of horizontal stability experiments across the four experimental datasets. The best performing models in each group are italicized and the overall best performing models are highlighted in boldface.

Table A.3: MAE, MAC and MAC_I results of horizontal stability experiments.

	MAE				MAC				MAC_I			
	M4	M3	Favorita	M5	M4	M3	Favorita	M5	M4	M3	Favorita	M5
NBEATS												
Base	**394.718**	**499.275**	-	-	***134.376***	***213.987***	-	-	***227.159***	***332.556***	-	-
PI_0.2	***395.853***	***502.700***	-	-	111.622	174.836	-	-	210.924	307.938	-	-
PI_0.4	399.912	509.828	-	-	95.540	147.076	-	-	197.034	287.171	-	-
PI_0.5	402.767	514.548	-	-	91.136	140.087	-	-	190.923	278.401	-	-
PI_0.6	406.096	519.994	-	-	***90.280***	***138.512***	-	-	185.418	270.782	-	-
PI_0.8	414.004	532.899	-	-	96.200	148.812	-	-	176.432	258.878	-	-
PI_1	423.414	548.274	-	-	108.536	170.653	-	-	***170.406***	***251.339***	-	-
FI_0.2	***395.882***	***502.870***	-	-	110.342	173.540	-	-	207.982	303.648	-	-
FI_0.4	400.712	511.377	-	-	87.452	135.625	-	-	182.623	265.981	-	-
FI_0.5	404.702	517.840	-	-	75.870	116.670	-	-	166.049	241.683	-	-
FI_0.6	410.092	526.370	-	-	63.869	97.269	-	-	145.728	212.029	-	-
FI_0.8	427.619	552.548	-	-	36.841	54.854	-	-	89.058	129.554	-	-
FI_1	462.590	602.756	-	-	**0.000**	**0.000**	-	-	**0.000**	**0.000**	-	-
PR												
Base	**457.977**	**563.163**	**2.426**	**5.321**	***84.115***	***193.529***	***0.646***	***0.806***	***154.122***	***334.116***	***0.838***	***1.771***
PI_0.2	***458.768***	***564.833***	***2.427***	***5.324***	71.767	165.378	0.512	0.726	144.034	311.440	0.772	1.728
PI_0.4	460.127	568.983	2.435	5.334	63.150	145.159	0.414	0.683	135.063	291.628	0.722	1.696
PI_0.5	461.010	571.941	2.441	5.341	60.707	139.285	0.386	***0.677***	131.027	282.893	0.703	1.684
PI_0.6	462.025	575.431	2.448	5.350	***59.856***	***136.964***	***0.382***	0.681	127.305	274.976	0.689	1.675
PI_0.8	464.442	583.992	2.468	5.373	62.236	141.832	0.432	0.718	120.872	261.742	0.671	1.663
PI_1	467.373	594.489	2.494	5.402	68.180	155.713	0.521	0.784	***115.895***	***252.152***	***0.669***	***1.662***
FI_0.2	***458.902***	***564.866***	***2.427***	***5.324***	70.655	162.566	0.508	0.699	141.909	306.679	0.761	1.715
FI_0.4	460.859	569.868	2.434	5.336	57.116	130.586	0.382	0.564	124.880	268.988	0.668	1.636
FI_0.5	462.375	574.133	2.440	5.344	49.974	113.574	0.322	0.483	113.567	244.276	0.608	1.583
FI_0.6	464.405	579.966	2.447	5.355	42.393	95.594	0.262	0.396	99.639	214.076	0.536	1.512
FI_0.8	471.064	598.962	2.473	5.383	24.778	54.790	0.142	0.211	60.778	130.350	0.331	1.226
FI_1	485.115	639.090	2.535	5.579	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
LightGBM												
Base	**473.849**	**562.678**	***2.567***	**5.161**	***81.285***	***148.911***	***0.533***	***0.720***	***163.983***	***264.938***	***0.787***	***1.524***
PI_0.2	***474.832***	***564.775***	***2.567***	***5.168***	69.503	123.632	0.428	0.651	153.472	246.933	0.734	1.485
PI_0.4	476.351	568.546	2.573	5.183	61.547	106.278	0.353	0.612	143.784	230.916	0.690	1.457
PI_0.5	477.305	571.004	2.577	5.193	59.497	102.145	0.332	***0.606***	139.279	223.689	0.671	1.447
PI_0.6	478.382	573.808	2.582	5.205	***58.919***	***101.544***	***0.329***	0.608	135.025	217.063	0.656	1.439
PI_0.8	480.906	580.468	2.594	5.233	61.074	107.958	0.364	0.638	127.319	205.641	0.632	***1.430***
PI_1	483.912	588.472	2.609	5.267	66.282	121.241	0.428	0.696	***120.836***	***196.892***	***0.617***	1.431
FI_0.2	***474.885***	***564.993***	2.566	***5.169***	68.576	122.602	0.426	0.629	151.343	243.566	0.723	1.472
FI_0.4	476.620	570.024	2.567	5.186	56.155	97.843	0.328	0.511	133.490	214.309	0.640	1.399
FI_0.5	477.826	573.824	2.566	5.198	49.664	85.309	0.281	0.441	121.519	194.943	0.584	1.351
FI_0.6	479.377	578.842	2.565	5.212	42.700	72.262	0.232	0.363	106.705	171.117	0.515	1.287
FI_0.8	484.489	594.154	2.559	5.238	25.734	42.320	0.129	0.194	65.140	104.529	0.318	1.038
FI_1	496.707	624.674	**2.556**	5.348	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Table A.4: RMSE, RMSC and RMSC_I results of horizontal stability experiments.

	RMSE				RMSC				RMSC_I			
	M4	M3	Favorita	M5	M4	M3	Favorita	M5	M4	M3	Favorita	M5
NBEATS												
Base	**468.469**	**591.192**	-	-	***163.161***	***253.761***	-	-	***258.136***	***379.605***	-	-
PI_0.2	***469.951***	***595.571***	-	-	133.781	206.475	-	-	239.014	350.515	-	-
PI_0.4	475.628	604.764	-	-	112.751	172.320	-	-	224.053	328.056	-	-
PI_0.5	479.624	610.943	-	-	107.632	163.892	-	-	218.625	320.070	-	-
PI_0.6	484.271	618.069	-	-	***107.341***	***163.392***	-	-	214.786	314.602	-	-
PI_0.8	495.281	634.880	-	-	120.047	184.098	-	-	***211.929***	***311.318***	-	-
PI_1	508.265	654.678	-	-	144.374	223.235	-	-	214.794	317.112	-	-
FI_0.2	***469.908***	***595.634***	-	-	132.668	205.043	-	-	235.616	345.424	-	-
FI_0.4	475.993	605.894	-	-	103.856	159.324	-	-	206.878	302.342	-	-
FI_0.5	480.859	613.672	-	-	89.499	136.644	-	-	188.454	274.980	-	-
FI_0.6	487.317	623.752	-	-	74.796	113.533	-	-	165.968	241.804	-	-
FI_0.8	507.858	654.571	-	-	42.458	63.489	-	-	102.698	149.260	-	-
FI_1	549.194	713.866	-	-	**0.000**	**0.000**	-	-	**0.000**	**0.000**	-	-
PR												
Base	**535.777**	**660.323**	***3.125***	**6.587**	***100.623***	***229.583***	***0.789***	***1.048***	***173.514***	***378.959***	***0.960***	***2.015***
PI_0.2	***536.660***	***662.632***	***3.123***	***6.589***	84.858	193.961	0.616	0.926	162.335	353.674	0.874	1.952
PI_0.4	538.340	667.922	3.130	6.599	73.933	169.189	0.491	0.857	153.402	333.705	0.813	1.914
PI_0.5	539.475	671.652	3.137	6.608	71.283	163.063	***0.461***	***0.847***	149.976	326.183	0.796	1.905
PI_0.6	540.805	676.080	3.146	6.618	***70.996***	***162.212***	0.462	0.855	147.337	320.522	***0.788***	***1.903***
PI_0.8	544.039	686.958	3.170	6.644	77.132	175.591	0.547	0.923	***144.509***	***314.992***	0.802	1.919
PI_1	548.016	700.383	3.203	6.678	89.705	203.558	0.698	1.044	144.801	316.793	0.849	1.960
FI_0.2	***536.797***	***662.546***	**3.122**	***6.589***	83.687	190.999	0.614	0.895	159.812	347.928	0.862	1.929
FI_0.4	539.090	668.280	3.126	6.601	66.900	152.164	0.457	0.714	141.133	306.039	0.749	1.811
FI_0.5	540.881	672.990	3.130	6.611	58.206	131.919	0.383	0.612	128.779	278.634	0.680	1.734
FI_0.6	543.276	679.448	3.137	6.622	49.073	110.666	0.310	0.503	113.516	245.055	0.599	1.640
FI_0.8	551.006	700.973	3.161	6.648	28.268	62.841	0.166	0.272	70.227	150.958	0.372	1.319
FI_1	567.268	747.542	3.225	6.833	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
LightGBM												
Base	**551.580**	**660.952**	**3.167**	**6.361**	***99.339***	***179.370***	***0.644***	***0.934***	***183.905***	***299.995***	***0.898***	***1.753***
PI_0.2	***552.850***	***663.372***	***3.169***	***6.370***	83.861	147.885	0.513	0.824	172.368	279.315	0.829	1.697
PI_0.4	554.917	667.941	3.177	6.388	73.135	125.572	0.418	0.761	162.820	262.735	0.779	1.663
PI_0.5	556.242	670.995	3.183	6.400	70.538	120.257	0.395	***0.752***	158.967	256.407	0.762	1.655
PI_0.6	557.757	674.538	3.190	6.415	***70.264***	***120.162***	***0.395***	0.759	155.809	251.591	***0.753***	***1.653***
PI_0.8	561.342	683.008	3.208	6.450	76.274	134.105	0.455	0.818	151.682	***246.609***	0.753	1.668
PI_1	565.641	693.189	3.232	6.493	88.557	160.268	0.567	0.925	***150.396***	247.354	0.777	1.707
FI_0.2	***552.898***	***663.524***	***3.168***	***6.371***	82.878	146.835	0.511	0.798	169.876	275.358	0.818	1.675
FI_0.4	555.158	669.106	3.170	6.394	66.816	116.194	0.389	0.639	150.557	242.821	0.719	1.566
FI_0.5	556.721	673.420	3.171	6.410	58.524	100.777	0.331	0.549	137.640	221.526	0.656	1.496
FI_0.6	558.698	679.098	3.172	6.427	49.761	84.797	0.273	0.452	121.552	195.288	0.579	1.409
FI_0.8	565.002	696.824	3.173	6.460	29.285	48.794	0.151	0.244	75.430	120.904	0.361	1.124
FI_1	579.705	733.031	3.188	6.586	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**