

# Exploratory Data Analysis — VLO Next-Day Direction

Generated: 2026-02-10 23:28:20

Dataset: Engineered features joined across VLO, PSX, MPC, ^GSPC, CL=F, GC=F, ^VIX.  
This report includes schema, missing values, numeric summaries, and univariate feature analyses.  
Also includes target comparisons for: y, vlo\_next\_dir, vlo\_next\_ret.  
NEW: Includes numeric stats + tests for vlo\_next\_dir (positive vs negative) on vlo\_next\_ret.

# Schema: dtypes, Non-Null Counts, Missing Ratios (page 1/2)

column	dtype	non_null	nulls	null_ratio
ret_VLO	float64	3448	0	0.0%
ret_PSX	float64	3448	0	0.0%
ret_MPC	float64	3448	0	0.0%
ret_^GSPC	float64	3448	0	0.0%
ret_CL=F	float64	3448	0	0.0%
ret_GC=F	float64	3448	0	0.0%
ret_^VIX	float64	3448	0	0.0%
ret2_VLO	float64	3448	0	0.0%
ret2_PSX	float64	3448	0	0.0%
ret2_MPC	float64	3448	0	0.0%
ret2_^GSPC	float64	3448	0	0.0%
ret2_CL=F	float64	3448	0	0.0%
ret2_GC=F	float64	3448	0	0.0%
ret2_^VIX	float64	3448	0	0.0%
PX_VLO	float64	3448	0	0.0%
PX_PSX	float64	3448	0	0.0%
PX_MPC	float64	3448	0	0.0%
PX_^GSPC	float64	3448	0	0.0%
PX_CL=F	float64	3448	0	0.0%
PX_GC=F	float64	3448	0	0.0%
PX_^VIX	float64	3448	0	0.0%
PXlag1_VLO	float64	3448	0	0.0%
PXlag1_PSX	float64	3448	0	0.0%
PXlag1_MPC	float64	3448	0	0.0%
PXlag1_^GSPC	float64	3448	0	0.0%
PXlag1_CL=F	float64	3448	0	0.0%
PXlag1_GC=F	float64	3448	0	0.0%
PXlag1_^VIX	float64	3448	0	0.0%
PXlag2_VLO	float64	3448	0	0.0%
PXlag2_PSX	float64	3448	0	0.0%
PXlag2_MPC	float64	3448	0	0.0%
PXlag2_^GSPC	float64	3448	0	0.0%
PXlag2_CL=F	float64	3448	0	0.0%
PXlag2_GC=F	float64	3448	0	0.0%
PXlag2_^VIX	float64	3448	0	0.0%
VOL_VLO	int64	3448	0	0.0%
VOL_PSX	int64	3448	0	0.0%
VOL_MPC	int64	3448	0	0.0%
VOL_^GSPC	int64	3448	0	0.0%
VOL_CL=F	int64	3448	0	0.0%
VOL_GC=F	int64	3448	0	0.0%
VOL_^VIX	int64	3448	0	0.0%
HL_VLO	float64	3448	0	0.0%
OC_VLO	float64	3448	0	0.0%
HL_PSX	float64	3448	0	0.0%

# Schema: dtypes, Non-Null Counts, Missing Ratios (page 2/2)

column	dtype	non_null	nulls	null_ratio
OC_PSX	float64	3448	0	0.0%
HL_MPC	float64	3448	0	0.0%
OC_MPC	float64	3448	0	0.0%
HL_^GSPC	float64	3448	0	0.0%
OC_^GSPC	float64	3448	0	0.0%
HL_CL=F	float64	3448	0	0.0%
OC_CL=F	float64	3448	0	0.0%
HL_GC=F	float64	3448	0	0.0%
OC_GC=F	float64	3448	0	0.0%
HL_^VIX	float64	3448	0	0.0%
OC_^VIX	float64	3448	0	0.0%
vlo_next_ret	float64	3448	0	0.0%
vlo_next_dir	object	3448	0	0.0%
y	int64	3448	0	0.0%
EquityDown_OilDown	int64	3448	0	0.0%
RiskOff	int64	3448	0	0.0%
HighVIX	int64	3448	0	0.0%
VLO_vol5	float64	3448	0	0.0%
VLO_vol10	float64	3448	0	0.0%
VLO_vol20	float64	3448	0	0.0%
VLO_vol_ratio_5_20	float64	3448	0	0.0%
OilShock	int64	3448	0	0.0%
GoldShock	int64	3448	0	0.0%
VLO_minus_SPX	float64	3448	0	0.0%
RefinerPeerAvg	float64	3448	0	0.0%
VLO_minus_Peers	float64	3448	0	0.0%
Oil_minus_SPX	float64	3448	0	0.0%
Oil_minus_Refiners	float64	3448	0	0.0%
VLO_mom3	float64	3448	0	0.0%
VLO_mom5	float64	3448	0	0.0%
VLO_ret5_avg	float64	3448	0	0.0%
VLO_reversal_signal	float64	3448	0	0.0%
VLO_zscore20	float64	3448	0	0.0%
SPX_zscore20	float64	3448	0	0.0%
Oil_zscore20	float64	3448	0	0.0%

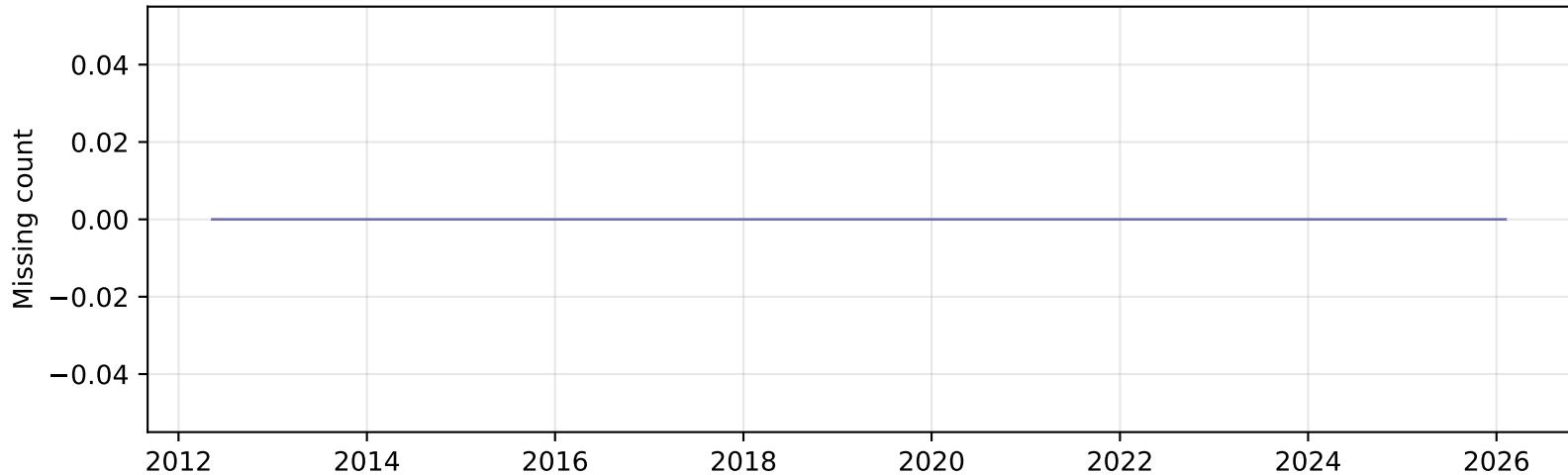
# Missing Values Summary (by Column) (page 1/2)

column	nulls	null_ratio_%
ret_VLO	0	0.0
ret_PSX	0	0.0
ret_MPC	0	0.0
ret_^GSPC	0	0.0
ret_CL=F	0	0.0
ret_GC=F	0	0.0
ret_^VIX	0	0.0
ret2_VLO	0	0.0
ret2_PSX	0	0.0
ret2_MPC	0	0.0
ret2_^GSPC	0	0.0
ret2_CL=F	0	0.0
ret2_GC=F	0	0.0
ret2_^VIX	0	0.0
PX_VLO	0	0.0
PX_PSX	0	0.0
PX_MPC	0	0.0
PX_^GSPC	0	0.0
PX_CL=F	0	0.0
PX_GC=F	0	0.0
PX_^VIX	0	0.0
PXlag1_VLO	0	0.0
PXlag1_PSX	0	0.0
PXlag1_MPC	0	0.0
PXlag1_^GSPC	0	0.0
PXlag1_CL=F	0	0.0
PXlag1_GC=F	0	0.0
PXlag1_^VIX	0	0.0
PXlag2_VLO	0	0.0
PXlag2_PSX	0	0.0
PXlag2_MPC	0	0.0
PXlag2_^GSPC	0	0.0
PXlag2_CL=F	0	0.0
PXlag2_GC=F	0	0.0
PXlag2_^VIX	0	0.0
VOL_VLO	0	0.0
VOL_PSX	0	0.0
VOL_MPC	0	0.0
VOL_^GSPC	0	0.0
VOL_CL=F	0	0.0
VOL_GC=F	0	0.0
VOL_^VIX	0	0.0
HL_VLO	0	0.0
OC_VLO	0	0.0
HL_PSX	0	0.0
OC_PSX	0	0.0
HL_MPC	0	0.0
OC_MPC	0	0.0
HL_^GSPC	0	0.0
OC_^GSPC	0	0.0

## Missing Values Summary (by Column) (page 2/2)

column	nulls	null_ratio_%
HL_CL=F	0	0.0
OC_CL=F	0	0.0
HL_GC=F	0	0.0
OC_GC=F	0	0.0
HL_^VIX	0	0.0
OC_^VIX	0	0.0
vlo_next_ret	0	0.0
vlo_next_dir	0	0.0
y	0	0.0
EquityDown_OilDown	0	0.0
RiskOff	0	0.0
HighVIX	0	0.0
VLO_vol5	0	0.0
VLO_vol10	0	0.0
VLO_vol20	0	0.0
VLO_vol_ratio_5_20	0	0.0
OilShock	0	0.0
GoldShock	0	0.0
VLO_minus_SPX	0	0.0
RefinerPeerAvg	0	0.0
VLO_minus_Peers	0	0.0
Oil_minus_SPX	0	0.0
Oil_minus_Refiners	0	0.0
VLO_mom3	0	0.0
VLO_mom5	0	0.0
VLO_ret5_avg	0	0.0
VLO_reversal_signal	0	0.0
VLO_zscore20	0	0.0
SPX_zscore20	0	0.0
Oil_zscore20	0	0.0

Total Missing Values per Date



# Numeric Summary: count / mean / std / min / max (page 1/3)

feature	count	mean	std	min	max
ret_VLO	3448.0	0.000807	0.023973	-0.213452	0.271572
ret_PSX	3448.0	0.000598	0.021071	-0.172757	0.200262
ret_MPC	3448.0	0.0008	0.024398	-0.314833	0.187546
ret_^GSPC	3448.0	0.000476	0.010633	-0.127652	0.090895
ret_CL=F	3448.0	-4e-05	0.025813	-0.282206	0.22394
ret_GC=F	3448.0	0.000314	0.010327	-0.120657	0.059054
ret_^VIX	3448.0	-3.7e-05	0.07856	-0.442449	0.768245
ret2_VLO	3448.0	0.000765	0.023859	-0.213452	0.271572
ret2_PSX	3448.0	0.000561	0.020999	-0.172757	0.200262
ret2_MPC	3448.0	0.000768	0.024281	-0.314833	0.187546
ret2_^GSPC	3448.0	0.000475	0.010628	-0.127652	0.090895
ret2_CL=F	3448.0	8.7e-05	0.026337	-0.282206	0.319634
ret2_GC=F	3448.0	0.000335	0.010332	-0.120657	0.059054
ret2_^VIX	3448.0	-6.6e-05	0.078615	-0.442449	0.768245
PX_VLO	3448.0	69.806336	41.408681	11.44617	196.210007
PX_PSX	3448.0	72.890858	29.47688	18.661123	162.348053
PX_MPC	3448.0	67.159122	50.183053	11.591083	211.11409
PX_^GSPC	3448.0	3269.216591	1445.490423	1278.040039	6978.600098
PX_CL=F	3448.0	68.407839	20.299975	12.34	123.699997
PX_GC=F	3448.0	1723.069778	667.210608	1050.800049	5318.399902
PX_^VIX	3448.0	17.663251	6.58695	9.14	82.690002
PXlag1_VLO	3448.0	69.752921	41.36612	11.44617	196.210007
PXlag1_PSX	3448.0	72.851226	29.457818	18.661123	162.348053
PXlag1_MPC	3448.0	67.105687	50.143812	11.591083	211.11409
PXlag1_^GSPC	3448.0	3267.613311	1444.612524	1278.040039	6978.600098
PXlag1_CL=F	3448.0	68.416198	20.309098	12.34	123.699997
PXlag1_GC=F	3448.0	1722.13979	665.077249	1050.800049	5318.399902
PXlag1_^VIX	3448.0	17.664115	6.589853	9.14	82.690002
PXlag2_VLO	3448.0	69.701045	41.320649	11.44617	191.101242
PXlag2_PSX	3448.0	72.813631	29.437593	18.661123	162.348053
PXlag2_MPC	3448.0	67.053093	50.103898	11.591083	211.11409
PXlag2_^GSPC	3448.0	3266.000689	1443.670702	1278.040039	6978.600098
PXlag2_CL=F	3448.0	68.422306	20.322219	10.01	123.699997
PXlag2_GC=F	3448.0	1721.160236	662.837474	1050.800049	5318.399902
PXlag2_^VIX	3448.0	17.666215	6.595777	9.14	82.690002

# Numeric Summary: count / mean / std / min / max (page 2/3)

feature	count	mean	std	min	max
VOL_VLO	3448.0	5099375.732019	2922242.476911	559800.0	44023700.0
VOL_PSX	3448.0	3233042.024362	1485206.416509	605700.0	16579800.0
VOL_MPC	3448.0	5480148.607889	3015020.926321	957900.0	39153800.0
VOL_^GSPC	3448.0	3978971600.928074	994887969.326019	0.0	9976520000.0
VOL_CL=F	3448.0	405261.074536	208295.861002	0.0	1774383.0
VOL_GC=F	3448.0	5177.583527	28053.519114	0.0	386334.0
VOL_^VIX	3448.0	0.0	0.0	0.0	0.0
HL_VLO	3448.0	2.482309	1.695443	0.292505	15.729996
OC_VLO	3448.0	-0.00526	1.777322	-12.120003	12.120003
HL_PSX	3448.0	2.226932	1.244532	0.409996	14.799995
OC_PSX	3448.0	-0.005316	1.504075	-10.279999	11.529999
HL_MPC	3448.0	2.161997	1.646007	0.275	17.680008
OC_MPC	3448.0	0.012539	1.600088	-12.770004	15.790001
HL_^GSPC	3448.0	35.3598	31.485094	3.699951	532.909668
OC_^GSPC	3448.0	0.622177	30.280579	-218.060059	491.620117
HL_CL=F	3448.0	2.107944	1.317756	0.48	23.209999
OC_CL=F	3448.0	-0.028068	1.444238	-15.960007	7.720001
HL_GC=F	3448.0	18.268446	24.884374	0.0	740.5
OC_GC=F	3448.0	0.112817	21.359635	-662.5	223.700195
HL_^VIX	3448.0	1.951853	2.173019	0.240001	42.340004
OC_^VIX	3448.0	-0.144658	1.64976	-17.360001	24.860001
vlo_next_ret	3448.0	0.000803	0.023984	-0.213452	0.271572
EquityDown_OilDown	3448.0	0.257251	0.437182	0.0	1.0
RiskOff	3448.0	0.183005	0.386726	0.0	1.0
HighVIX	3448.0	0.351218	0.47742	0.0	1.0
VLO_vol5	3448.0	0.020014	0.01326	0.001679	0.14472
VLO_vol10	3448.0	0.020801	0.011809	0.003353	0.131768
VLO_vol20	3448.0	0.0213	0.010802	0.005059	0.109765
VLO_vol_ratio_5_20	3448.0	0.940344	0.344439	0.118164	2.002188
OilShock	3448.0	0.057425	0.232686	0.0	1.0
GoldShock	3448.0	0.060035	0.237586	0.0	1.0
VLO_minus_SPX	3448.0	0.000331	0.020752	-0.140148	0.25994
RefinerPeerAvg	3448.0	0.000699	0.021565	-0.243795	0.172114
VLO_minus_Peers	3448.0	0.000108	0.011436	-0.058135	0.099458
Oil_minus_SPX	3448.0	-0.000516	0.025324	-0.296403	0.233195



feature	count	mean	std	min	max
Oil_minus_Refiners	3448.0	-0.000739	0.027067	-0.318885	0.240933
VLO_mom3	3448.0	0.00242	0.041127	-0.354102	0.334982
VLO_mom5	3448.0	0.00398	0.053133	-0.440812	0.369256
VLO_ret5_avg	3448.0	0.000796	0.010627	-0.088162	0.073851
VLO_reversal_signal	3448.0	-0.000796	0.010627	-0.073851	0.088162
VLO_zscore20	3448.0	-0.008158	0.979284	-3.910114	3.829063
SPX_zscore20	3448.0	-0.03648	0.990842	-3.779699	3.370961
Oil_zscore20	3448.0	-0.018075	0.982353	-3.749012	3.594037

# Numeric Percentile Distribution: 1% / 5% / 25% / 50% / 75% / 95% / 99% (page 1/3)

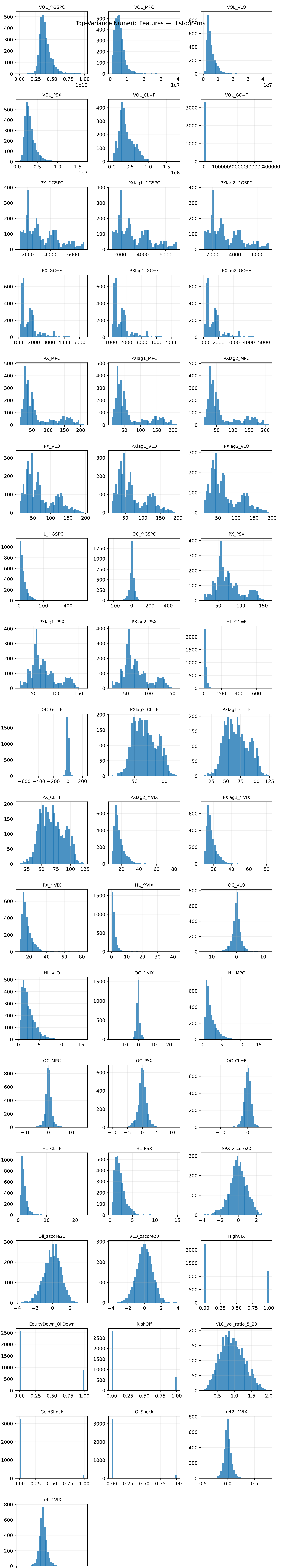
feature	1%	5%	25%	50%	75%	95%	99%
ret_VLO	-0.063444	-0.035806	-0.010663	0.001103	0.013092	0.035242	0.058894
ret_PSX	-0.059754	-0.032229	-0.009231	0.000965	0.011061	0.031491	0.052653
ret_MPC	-0.063416	-0.035569	-0.011236	0.001734	0.013241	0.035131	0.058943
ret_^GSPC	-0.030335	-0.015883	-0.003664	0.000687	0.005572	0.014839	0.024791
ret_CL=F	-0.069101	-0.037693	-0.011911	0.000953	0.012259	0.033466	0.060761
ret_GC=F	-0.026939	-0.016034	-0.004446	0.000351	0.005579	0.01597	0.026764
ret_^VIX	-0.181225	-0.11188	-0.04279	-0.006317	0.035626	0.126865	0.238451
ret2_VLO	-0.063444	-0.035806	-0.010663	0.001103	0.013056	0.035175	0.058245
ret2_PSX	-0.059754	-0.032229	-0.009242	0.000948	0.011061	0.031368	0.051687
ret2_MPC	-0.063416	-0.035569	-0.011236	0.001734	0.013271	0.035131	0.058673
ret2_^GSPC	-0.030335	-0.015883	-0.003664	0.000687	0.005567	0.014839	0.024699
ret2_CL=F	-0.068502	-0.037599	-0.011878	0.000965	0.012264	0.033622	0.061207
ret2_GC=F	-0.026939	-0.016014	-0.004433	0.000362	0.005591	0.015988	0.02716
ret2_^VIX	-0.181225	-0.11188	-0.04279	-0.006374	0.035517	0.126865	0.238451
PX_VLO	13.410843	20.981887	37.872153	58.335638	102.473793	147.976697	174.612492
PX_PSX	21.269063	34.99322	53.665302	65.678215	87.997719	132.019801	144.096944
PX_MPC	14.427143	21.146675	31.392739	45.767733	93.120556	171.637595	193.671339
PX_^GSPC	1343.751796	1486.634479	2075.112427	2840.290039	4277.909912	6068.220068	6854.699663
PX_CL=F	25.921	39.4335	52.34	66.990002	83.365	103.029999	109.949599
PX_GC=F	1082.74599	1166.670001	1272.775024	1564.400024	1887.75	3317.399902	4310.78104
PX_^VIX	9.7847	11.2135	13.41	15.97	20.022501	29.35	40.2001
PXlag1_VLO	13.328524	20.928538	37.852917	58.29747	102.419022	147.915677	174.081437
PXlag1_PSX	21.175475	34.852981	53.662681	65.642578	87.978289	132.007819	143.9531
PXlag1_MPC	14.382035	21.089094	31.392739	45.679808	93.053066	171.354291	193.40309
PXlag1_^GSPC	1343.751796	1482.703955	2074.83252	2839.60498	4275.352295	6067.259106	6854.699663
PXlag1_CL=F	25.921	39.4335	52.34	67.0	83.402498	103.029999	109.949599
PXlag1_GC=F	1082.74599	1166.670001	1272.775024	1564.400024	1887.350037	3317.294971	4305.666104
PXlag1_^VIX	9.7847	11.22	13.41	15.97	20.02	29.35	40.5132
PXlag2_VLO	13.277671	20.911479	37.852917	58.268829	102.363024	147.74051	173.866469
PXlag2_PSX	21.160243	34.44249	53.65227	65.615635	87.958441	131.990005	143.692498
PXlag2_MPC	14.246449	21.063217	31.381767	45.673971	92.610865	171.341048	193.02124
PXlag2_^GSPC	1343.751796	1475.538483	2074.317566	2839.544922	4274.157471	6064.703955	6851.476577
PXlag2_CL=F	25.921	39.4335	52.34	67.009998	83.475	103.029999	109.949599
PXlag2_GC=F	1082.74599	1166.670001	1272.775024	1564.400024	1887.224976	3315.805029	4302.432046
PXlag2_^VIX	9.7847	11.2135	13.4175	15.97	20.022501	29.35	40.730601

Numeric Percentile Distribution: 1% / 5% / 25% / 50% / 75% / 95% / 99% (page 2/3)							
Structure	1%	5%	25%	50%	75%	95%	99%
CL_VLO	1647676.0	2129610.0	3103375.0	4283900.0	6322675.0	10597915.0	14593296.0
CL_PSX	1243494.0	1617615.0	2285550.0	2898200.0	3779300.0	5991580.0	8476820.0
CL_MPC	1372523.0	1917580.0	3411525.0	5021050.0	6821600.0	10612620.0	15795870.0
CL^GSPC	2217460600.0	2812792500.0	3359732500.0	3776045000.0	4392155000.0	5773011999.999999	7755657499.999999
CL_CL=F	78269.72	121202.95	259122.5	351401.5	531567.25	791684.3	1005475.0
CL_GC=F	0.0	6.0	48.0	186.0	597.75	6064.15	181005.0
CL^VIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CL_VLO	0.501289	0.68	1.260002	2.029625	3.24	5.742503	8.250505
CL_VLO	-5.335895	-2.9165	-0.789998	0.059998	0.80579	2.696499	5.120505
CL_PSX	0.614698	0.8335	1.360001	1.950001	2.769998	4.589996	6.361105
CL_PSX	-4.1806	-2.526506	-0.75	0.029999	0.802502	2.310005	3.855996
CL_MPC	0.42735	0.630001	1.06	1.630001	2.75	5.330002	7.875205
CL_MPC	-4.897104	-2.346499	-0.68	0.029999	0.739999	2.323	4.670505
CL^GSPC	5.638806	7.833582	14.430115	26.135132	46.359985	93.692957	142.134105
CL^GSPC	-92.634072	-47.520563	-9.61261	1.25	13.262512	42.806982	74.441205
CL_CL=F	0.66	0.880001	1.330002	1.780001	2.480003	4.386001	7.090505
CL_CL=F	-3.945296	-2.279999	-0.779999	0.044998	0.779999	2.026501	3.567105
CL_GC=F	0.0	0.299927	7.300049	13.300049	22.400024	47.595013	96.176805
CL_GC=F	-51.412086	-24.165002	-6.0	0.0	6.900024	24.900104	50.305105
CL^VIX	0.360001	0.53	0.8875	1.38	2.27	4.8695	10.197105
CL^VIX	-3.8077	-2.003	-0.78	-0.22	0.349999	2.136501	4.857105
CL_next_ret	-0.063444	-0.035806	-0.010672	0.001103	0.013092	0.035293	0.058805
CLuityDown_OilDown	0.0	0.0	0.0	0.0	1.0	1.0	1.0
CLkOff	0.0	0.0	0.0	0.0	0.0	1.0	1.0
CLhVIX	0.0	0.0	0.0	0.0	1.0	1.0	1.0
CL_D_vol5	0.003873	0.00664	0.012261	0.017264	0.024268	0.040894	0.071305
CL_D_vol10	0.006518	0.009607	0.014105	0.018381	0.02425	0.038342	0.071905
CL_D_vol20	0.00805	0.011203	0.015607	0.019288	0.02356	0.037803	0.073605
CL_D_vol_ratio_5_20	0.257825	0.405771	0.684987	0.919242	1.1814	1.545331	1.755905
CLShock	0.0	0.0	0.0	0.0	0.0	1.0	1.0
CLldShock	0.0	0.0	0.0	0.0	0.0	1.0	1.0
CL_D_minus_SPX	-0.054642	-0.032412	-0.010242	0.000543	0.011071	0.032438	0.055205
CLfinerPeerAvg	-0.057464	-0.032202	-0.009396	0.001258	0.011878	0.031246	0.050705
CL_D_minus_Peers	-0.027845	-0.018087	-0.006282	0.000141	0.006255	0.017666	0.030005
CL_D_minus_SPX	-0.066179	-0.037248	-0.011978	-0.000265	0.011921	0.034377	0.060905

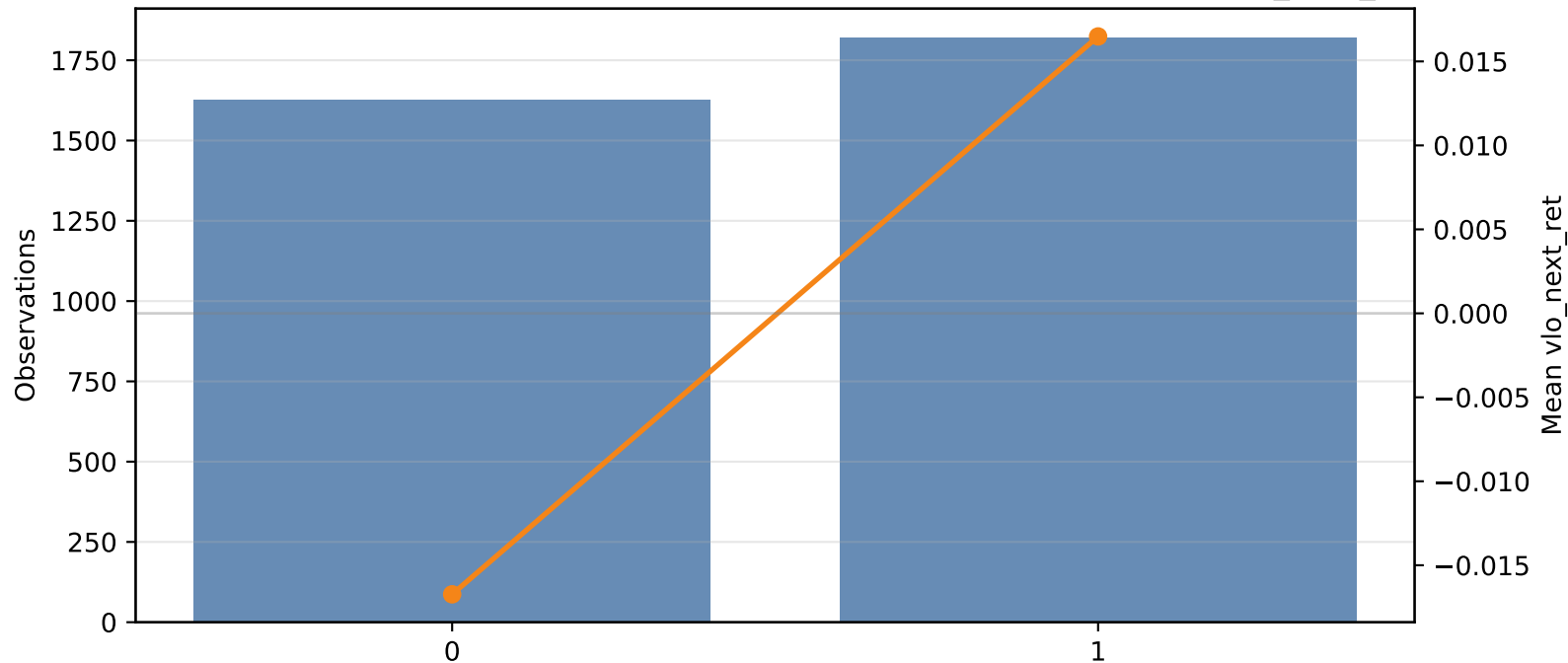
# Numeric Percentile Distribution: 1% / 5% / 25% / 50% / 75% / 95% / 99% (page 3/3)

feature	1%	5%	25%	50%	75%	95%	99%
Oil_minus_Refiners	-0.063243	-0.038046	-0.014945	-0.000738	0.012774	0.03787	0.067054
VLO_mom3	-0.107465	-0.06365	-0.018708	0.00324	0.025139	0.060549	0.095956
VLO_mom5	-0.143995	-0.080197	-0.023564	0.005388	0.033955	0.080828	0.133778
VLO_ret5_avg	-0.028799	-0.016039	-0.004713	0.001078	0.006791	0.016166	0.026756
VLO_reversal_signal	-0.026756	-0.016166	-0.006791	-0.001078	0.004713	0.016039	0.028799
VLO_zscore20	-2.429621	-1.641285	-0.624753	-0.000463	0.632667	1.554669	2.272825
SPX_zscore20	-2.642379	-1.698661	-0.611246	-0.034625	0.595334	1.575401	2.113883
Oil_zscore20	-2.450554	-1.685601	-0.64713	0.029539	0.643936	1.532993	2.075681

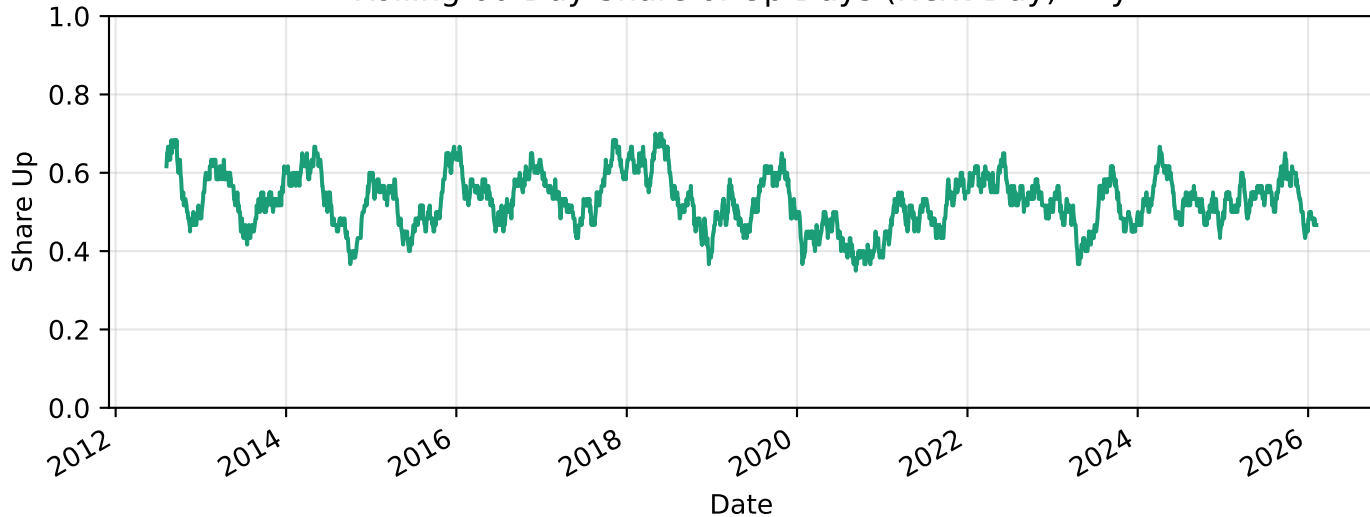
Top-Variance Numeric Features — Histograms



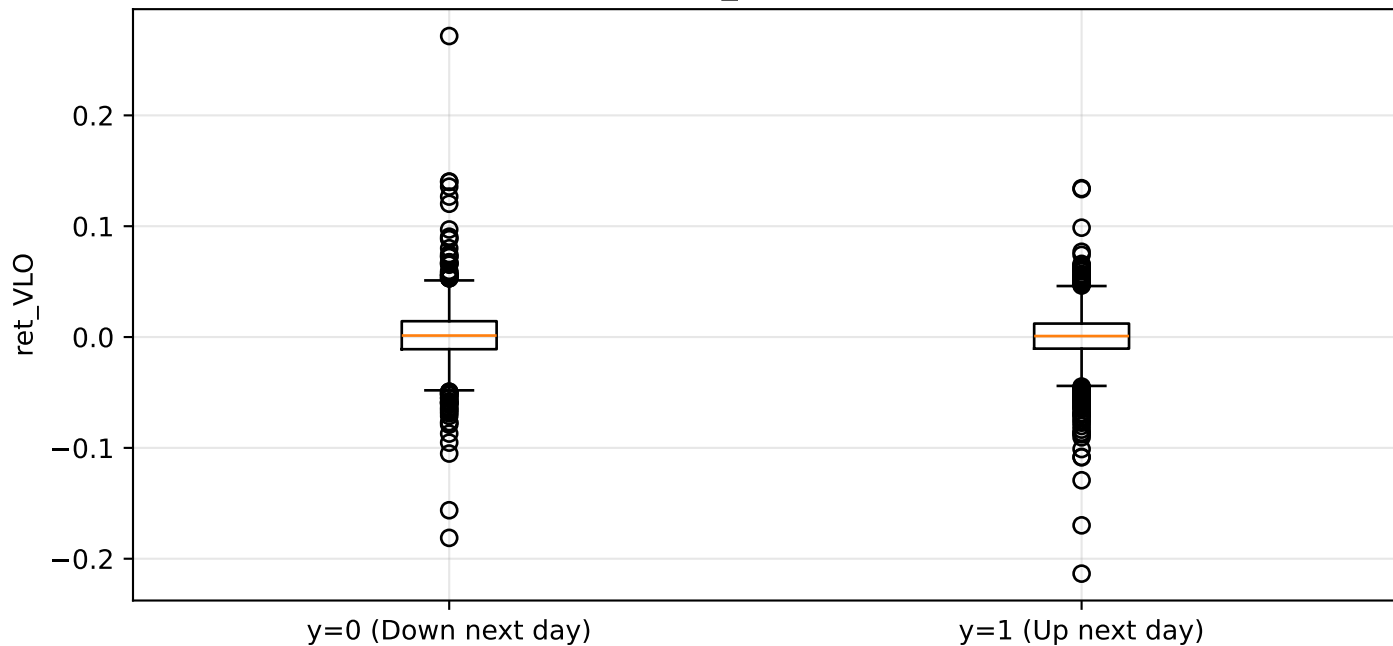
Class Counts — y (VLO Next-Day Direction) + Mean Next-Day Return (vlo\_next\_ret)



Rolling 60-Day Share of Up Days (Next-Day) — y

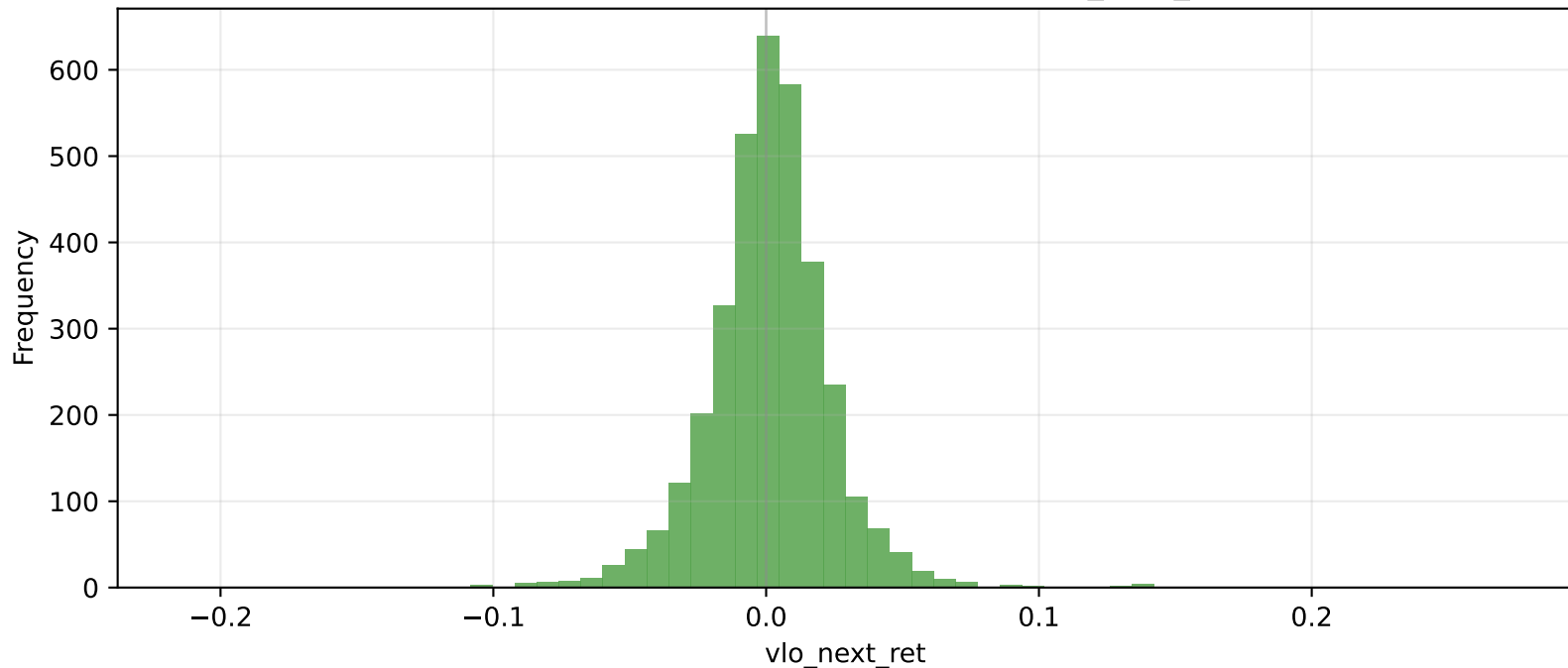


VLO Daily Log Returns (ret\_VLO) by Next-Day Direction (y)

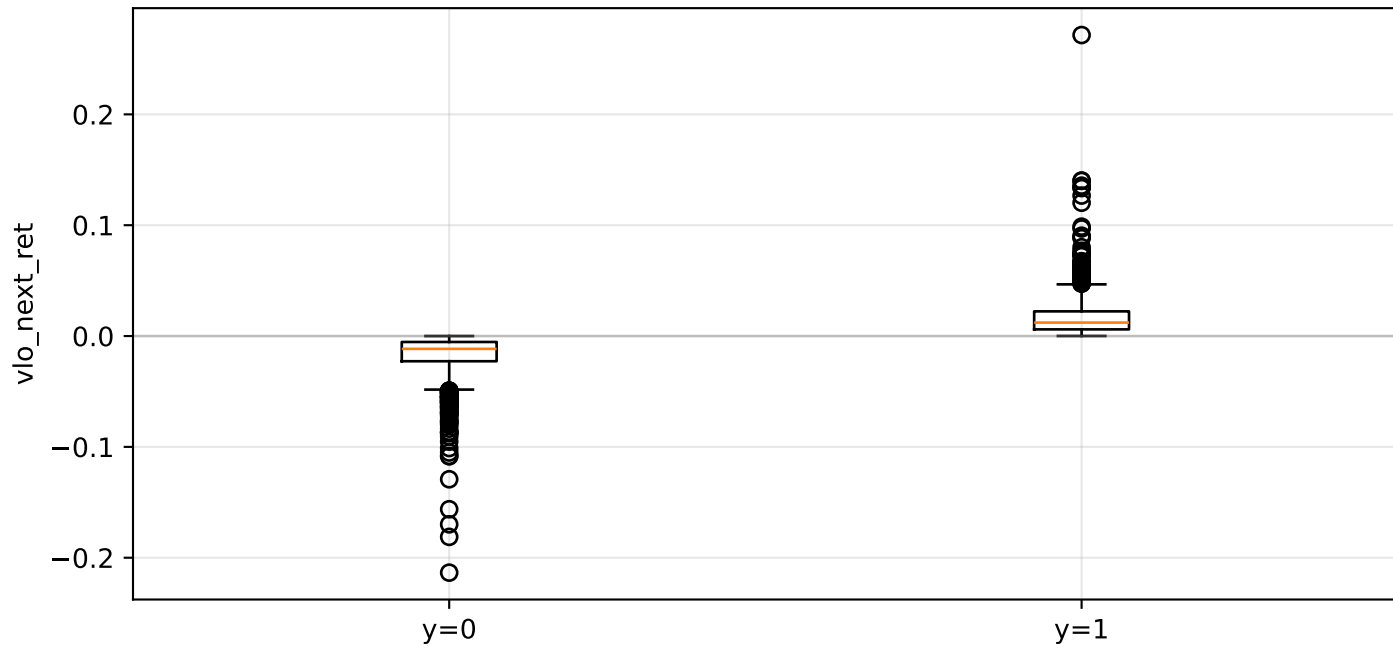




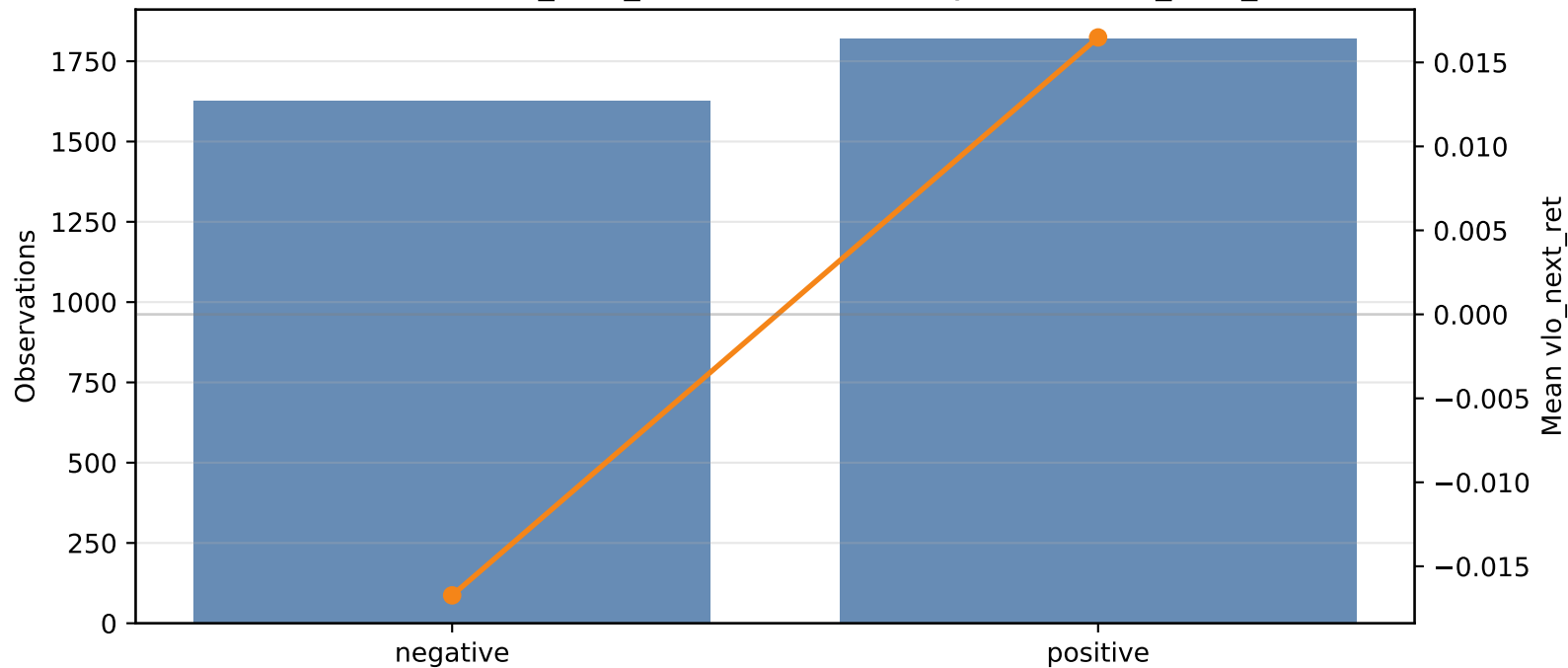
Distribution — Next-Day VLO Return (vlo\_next\_ret)



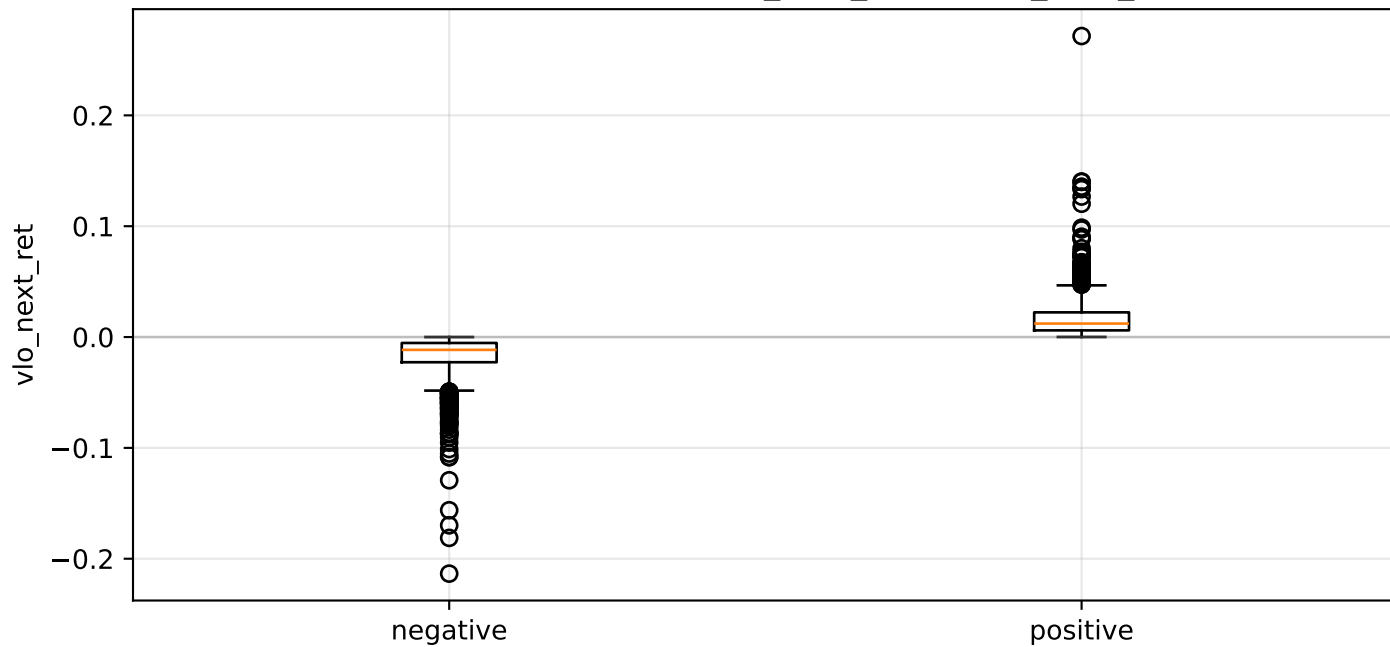
Next-Day VLO Return (vlo\_next\_ret) by y



Class Counts — vlo\_next\_dir + Mean Next-Day Return (vlo\_next\_ret)



Next-Day VLO Return (vlo\_next\_ret) by vlo\_next\_dir



Next-Day Return Stats by vlo\_next\_dir (metrics as rows; groups as columns)

metric	negative	positive
n	1628.0	1820.0
mean	-0.01673035	0.01648653
median	-0.01155576	0.01214965
std	0.017924	0.01677679
sem	0.00044423	0.00039325
min	-0.21345156	6.443e-05
p01	-0.07992257	0.00026205
p05	-0.04809042	0.0010695
p25	-0.02272456	0.00602375
p75	-0.0053461	0.02227642
p95	-0.00087915	0.04504588
p99	-0.00013109	0.07259571
max	0.0	0.27157194
skew	-3.35141102	4.13662082
kurtosis_excess	21.49592595	38.85318897
win_rate	0.0	1.0
mean_if_up	nan	0.01648653
mean_if_down	-0.01683376	nan
sharpe_ann	-14.81734408	15.59986187
t_mean_vs_0	-37.66147246	41.92336907
p_mean_vs_0	0.0	0.0

Between-Group Comparison (positive vs negative): metrics as rows

metric	value
pos_label	positive
neg_label	negative
n_pos	1820
n_neg	1628
mean_pos	0.01648653
mean_neg	-0.01673035
mean_diff_pos_minus_neg	0.03321689
median_pos	0.01214965
median_neg	-0.01155576
median_diff_pos_minus_neg	0.02370541
std_pos	0.01677679
std_neg	0.017924
welch_t	55.98792907
welch_p	0.0
ks_stat	1.0
ks_p	0.0
cohens_d	1.91695927
cliffs_delta	1.0
win_rate_pos	1.0
win_rate_neg	0.0
win_rate_diff_pos_minus_neg	1.0

# All Features — Univariate Associations with y (page 1/2)

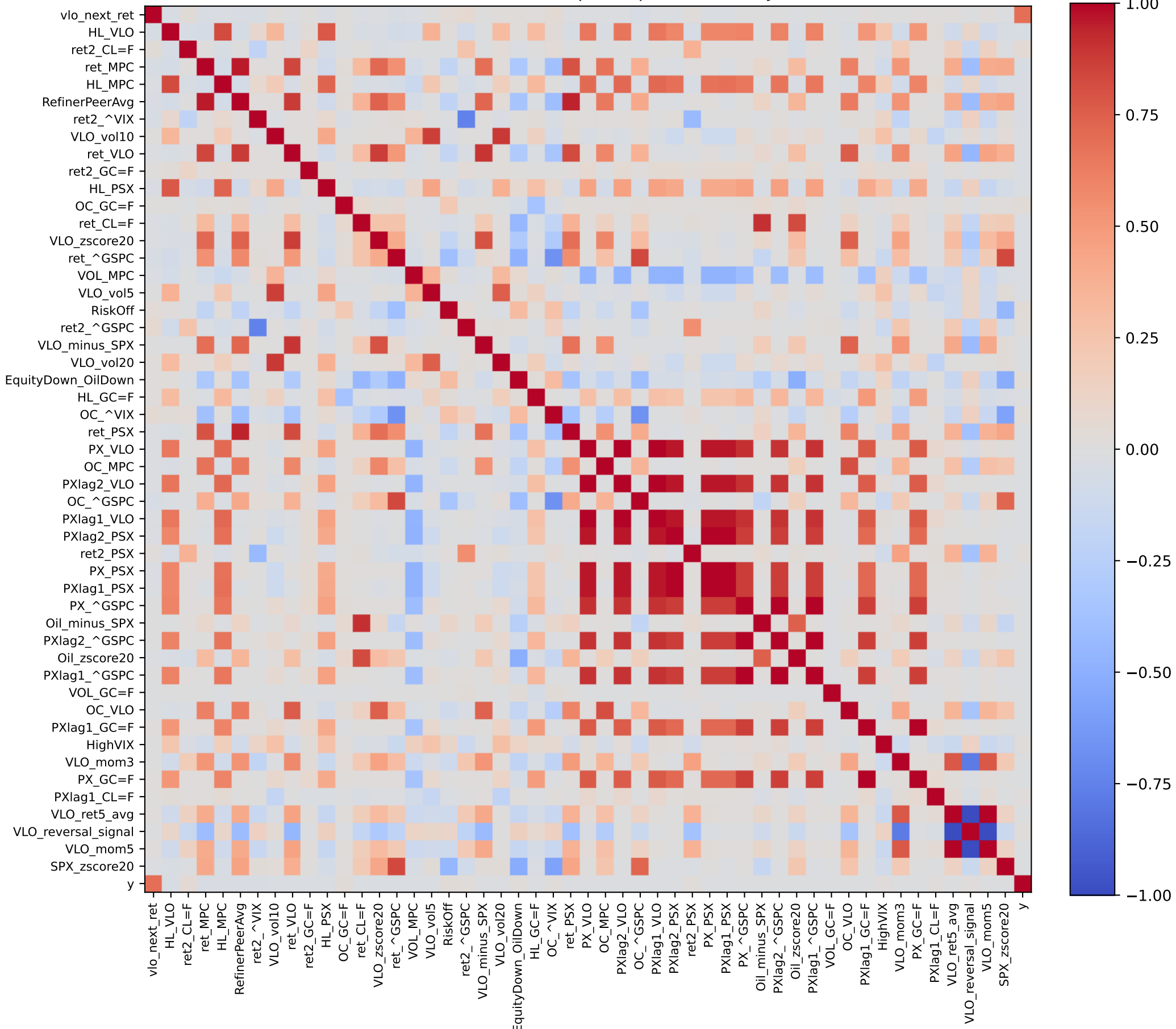
feature	corr_y	abs_corr_y	tstat_y	ks_y	auc_y	mi_y
vlo_next_ret	0.691505	0.691505	55.987929	1.0	1.0	0.691741
HL_VLO	-0.046045	0.046045	-2.688072	0.038474	0.480136	0.0
ret2_CL=F	0.041076	0.041076	2.431799	0.03974	0.520831	0.000194
ret_MPC	-0.040133	0.040133	-2.358049	0.035606	0.490424	0.0
HL_MPC	-0.03244	0.03244	-1.894876	0.039294	0.4842	0.0
RefinerPeerAvg	-0.031592	0.031592	-1.85431	0.023803	0.496759	0.006697
ret2_^VIX	-0.031387	0.031387	-1.836539	0.044836	0.484461	0.003393
VLO_vol10	-0.031058	0.031058	-1.815622	0.03114	0.487767	0.0
ret_VLO	-0.029653	0.029653	-1.734045	0.038749	0.490558	0.00678
ret2_GC=F	-0.028534	0.028534	-1.677799	0.049113	0.4759	0.0
HL_PSX	-0.026983	0.026983	-1.573757	0.029387	0.494262	0.010954
OC_GC=F	0.026437	0.026437	1.538385	0.038386	0.519364	0.0
ret_CL=F	-0.025338	0.025338	-1.488233	0.050185	0.485804	0.0
VLO_zscore20	-0.025066	0.025066	-1.469879	0.03978	0.487339	0.011347
ret_^GSPC	-0.024854	0.024854	-1.455634	0.035942	0.485628	0.009192
VOL_MPC	-0.024309	0.024309	-1.426265	0.028077	0.488932	0.0
VLO_vol5	-0.024115	0.024115	-1.410738	0.035546	0.48958	0.016554
RiskOff	0.023936	0.023936	1.40861	0.01854	0.50927	0.011565
ret2_^GSPC	0.022097	0.022097	1.293884	0.018124	0.500832	0.001433
VLO_minus_SPX	-0.02152	0.02152	-1.256988	0.027358	0.494203	0.0
VLO_vol20	-0.021356	0.021356	-1.250123	0.028107	0.49171	0.003947
EquityDown_OilDown	0.021004	0.021004	1.234876	0.018391	0.509196	0.0
HL_GC=F	-0.019178	0.019178	-1.111587	0.025508	0.489386	0.021829
OC_^VIX	0.018429	0.018429	1.081582	0.023634	0.506621	0.0
ret_PSX	-0.018196	0.018196	-1.066811	0.027899	0.50323	0.0
PX_VLO	-0.017936	0.017936	-1.05193	0.02568	0.489112	0.0
OC_MPC	-0.017884	0.017884	-1.042651	0.019983	0.498778	0.0
PXlag2_VLO	-0.017558	0.017558	-1.029688	0.027135	0.49015	0.009596
OC_^GSPC	-0.017203	0.017203	-1.006782	0.040273	0.489487	0.007856
PXlag1_VLO	-0.01707	0.01707	-1.001113	0.023675	0.490226	0.0
PXlag2_PSX	-0.01705	0.01705	-1.000735	0.029352	0.491132	0.008608
ret2_PSX	0.016883	0.016883	0.986173	0.028031	0.510244	0.0
PX_PSX	-0.016551	0.016551	-0.971599	0.026838	0.490286	0.009906
PXlag1_PSX	-0.015889	0.015889	-0.932685	0.023308	0.491358	0.0
PX_^GSPC	-0.015407	0.015407	-0.905195	0.045877	0.487471	0.002178
Oil_minus_SPX	-0.015391	0.015391	-0.902953	0.043558	0.490448	0.002935
PXlag2_^GSPC	-0.015309	0.015309	-0.899436	0.045457	0.487447	0.0
Oil_zscore20	-0.015002	0.015002	-0.879259	0.050545	0.487688	0.0
PXlag1_^GSPC	-0.014813	0.014813	-0.870264	0.04504	0.487653	0.0
VOL_GC=F	-0.014499	0.014499	-0.848358	0.047932	0.475643	0.005982

# All Features — Univariate Associations with y (page 2/2)

feature	corr_y	abs_corr_y	tstat_y	ks_y	auc_y	mi_y
OC_VLO	-0.013544	0.013544	-0.789147	0.034333	0.493486	0.0
PXlag1_GC=F	-0.011931	0.011931	-0.699399	0.033633	0.494957	0.001601
HighVIX	0.011906	0.011906	0.699265	0.011385	0.505692	0.0
VLO_mom3	-0.011636	0.011636	-0.681614	0.018055	0.499941	0.0
PX_GC=F	-0.011526	0.011526	-0.675751	0.032272	0.494708	0.0
PXlag1_CL=F	0.011439	0.011439	0.671402	0.019505	0.506672	0.011191
VLO_ret5_avg	-0.011399	0.011399	-0.667883	0.019181	0.499446	0.012324
VLO_reversal_signal	0.011399	0.011399	0.667883	0.019181	0.500554	0.01261
VLO_mom5	-0.011399	0.011399	-0.667883	0.019181	0.499446	0.012407
SPX_zscore20	-0.011239	0.011239	-0.658457	0.034125	0.490646	0.0
PXlag2_GC=F	-0.010728	0.010728	-0.629102	0.033404	0.495475	0.0
PX_CL=F	0.010601	0.010601	0.622352	0.018567	0.50638	0.0
PX_MPC	-0.010523	0.010523	-0.61723	0.02179	0.493902	0.0
PXlag2_MPC	-0.010012	0.010012	-0.58725	0.017572	0.495094	0.002548
OC_CL=F	-0.009911	0.009911	-0.581858	0.046313	0.488169	0.0
PXlag1_MPC	-0.009728	0.009728	-0.57059	0.017882	0.49525	0.00455
OilShock	-0.008772	0.008772	-0.513979	0.004088	0.497956	0.018487
VLO_vol_ratio_5_20	-0.008744	0.008744	-0.512671	0.028386	0.494839	0.003344
PXlag2_CL=F	0.008461	0.008461	0.496608	0.019984	0.505344	0.00071
HL_^VIX	0.00828	0.00828	0.486896	0.022419	0.505396	0.0
ret2_MPC	0.006995	0.006995	0.408026	0.028654	0.50802	0.011492
VOL_VLO	0.006372	0.006372	0.374493	0.02268	0.502929	0.009458
VOL_^GSPC	-0.006298	0.006298	-0.369157	0.034453	0.490794	0.0
PXlag1_^VIX	-0.005568	0.005568	-0.325914	0.029828	0.502587	0.0
ret_GC=F	0.005329	0.005329	0.312486	0.023779	0.504586	0.0
PXlag2_^VIX	0.004721	0.004721	0.277173	0.027117	0.506014	0.003327
VOL_CL=F	-0.004695	0.004695	-0.275775	0.025037	0.495171	0.0
HL_^GSPC	-0.004262	0.004262	-0.249408	0.029191	0.492165	0.00745
VOL_PSX	-0.002749	0.002749	-0.16135	0.016006	0.499199	0.0
VLO_minus_Peers	-0.002587	0.002587	-0.151301	0.034718	0.496443	0.00647
OC_PSX	-0.002366	0.002366	-0.138405	0.026872	0.504938	0.007885
GoldShock	0.001802	0.001802	0.105795	0.000857	0.500429	0.0
HL_CL=F	-0.001141	0.001141	-0.067467	0.035487	0.488422	0.008737
Oil_minus_Refiners	0.001007	0.001007	0.05914	0.030179	0.493306	0.004601
PX_^VIX	-0.000871	0.000871	-0.051179	0.01846	0.500112	0.0
ret2_VLO	5.9e-05	5.9e-05	0.003424	0.026158	0.498461	0.020757
ret_^VIX	3.8e-05	3.8e-05	0.002239	0.0243	0.495705	0.000442
VOL_^VIX	nan	nan	nan	0.0	nan	0.0



Correlation Heatmap — Top Features vs y



vlo\_next\_ret by y



HL\_VLO by y



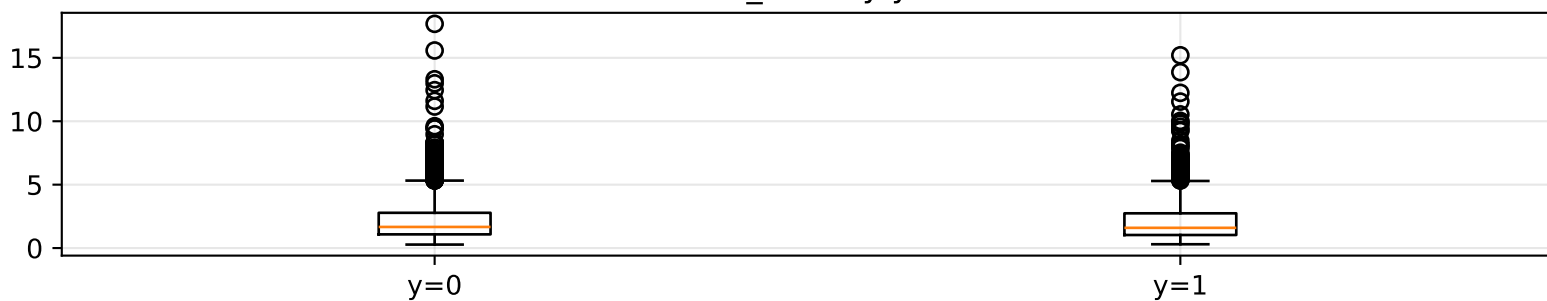
ret2\_CL=F by y



ret\_MPC by y



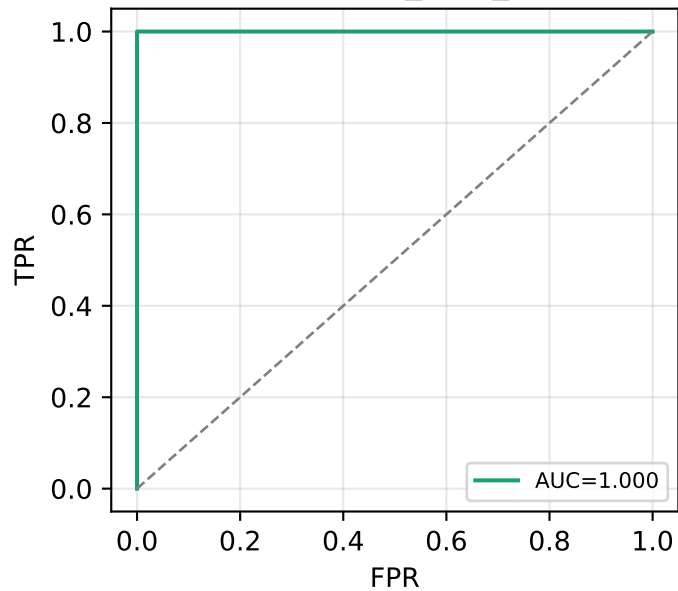
HL\_MPC by y



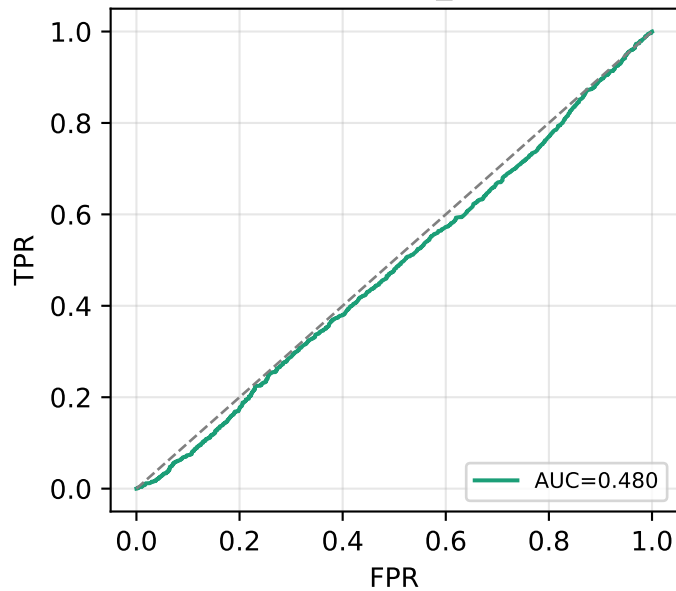
RefinerPeerAvg by y



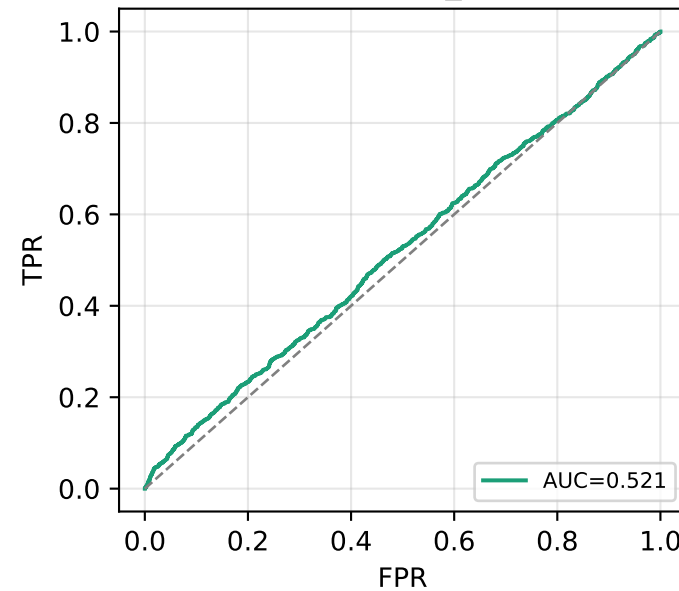
ROC — vlo\_next\_ret



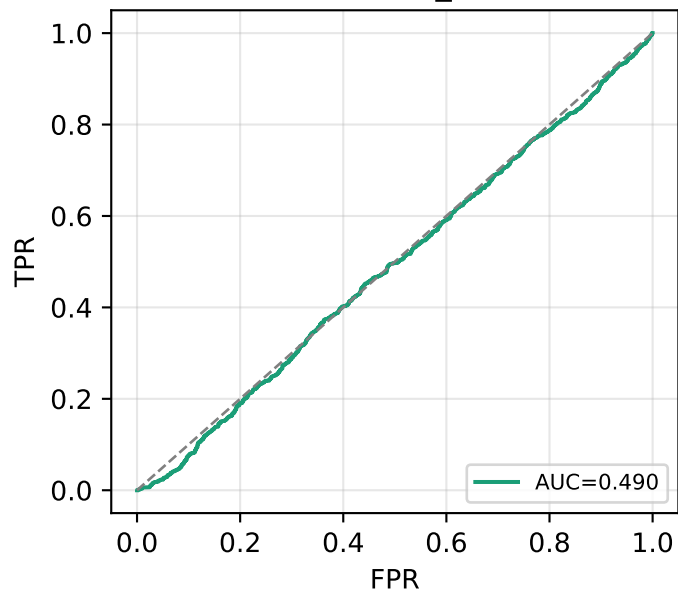
ROC — HL\_VLO



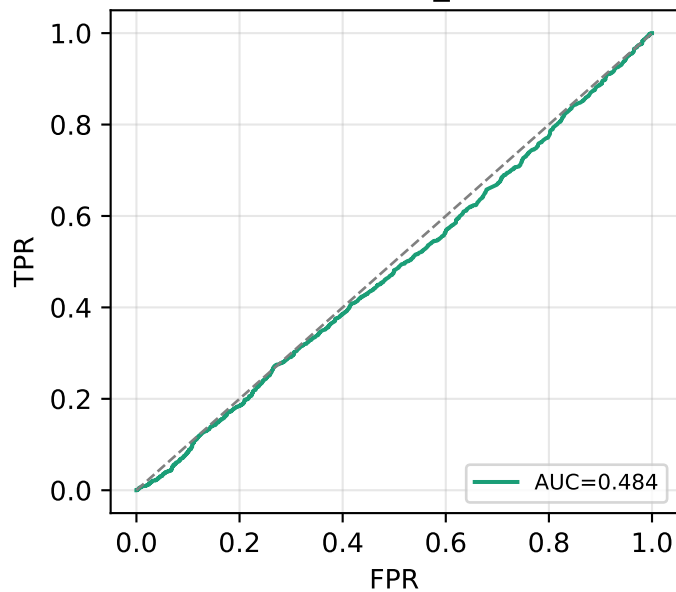
ROC — ret2\_CL=F



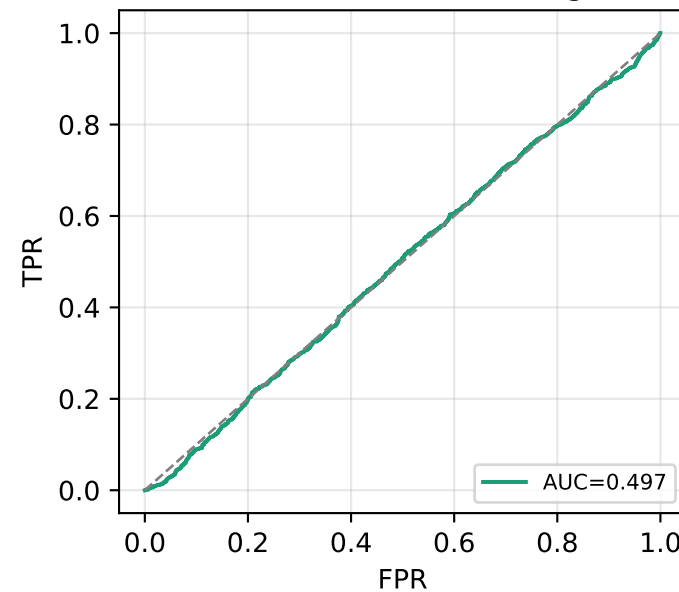
ROC — ret\_MPC



ROC — HL\_MPC



ROC — RefinerPeerAvg



## Class-Wise Summary (Key Series)

ret_1^GSPC mean	ret_1^GSPC std	ret_1^GSPC min	ret_1^GSPC median	ret_1^GSPC max	ret_CL=F count	ret_CL=F mean	ret_CL=F std	ret_CL=F min
0.000755	0.010892	-0.127652	0.000891	0.090895	1628.0	0.000652	0.025747	-0.099945
0.000226	0.010393	-0.099945	0.000487	0.089683	1820.0	-0.000658	0.025863	-0.127652

## Report Metadata

Report path: /mnt/batch/tasks/shared/LS\_root/mounts/clusters/dvandyk1/code/Users/dvandyk1

Rows in dataset: 3,448

Features (numeric): 78

sklearn available: True

scipy available: True

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