alamSYS: Development of Stock Market Price Forecasting System Using Dynamic Mode Decomposition, Long Short-Term Memory with Arnaud Legoux Moving Average Convergence-Divergence Integration

A Special Problem
Presented to
the Faculty of the Division of Physical Sciences and Mathematics
College of Arts and Sciences
University of the Philippines Visayas
Miag-ao, Iloilo

In Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science in Computer Science by

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Abstract

Abstract here

Keywords: Keyword 1, keyword 2, keyword 3, keyword 4, etc.

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Appendix A

Source Code Repository

Follow this link to access the code repository for this special problem: `https://github.com/GravitonXD/OLARTE_SP`. It should be noted that this repository also contains all of the miscellaneous files, such as the.tex files used to create this paper, test codes, and so on. The following are the primary directories for this project:

(a) alamSYS - contains the source code for alamSYS as well as the docker and docker-compose files.

(b) DeepLearningModel - contains all of the Python notebooks used in the development of this special problem for training, testing, and cross-validation of the models, trading algorithm, and other calculations.

(c) alamAPP - This directory contains the source code for the mobile-based test application.

Future developers who want to expand the functionality or dig deeper into this special problem can use the following repository links:

(a) alamSYS - `https://github.com/GravitonXD/alamSYS`

(b) DMD-LSTM - `https://github.com/GravitonXD/alamSYS_DMD-LSTM`

(c) alamAPP - `https://github.com/GravitonXD/alamAPP`

Appendix B

Raw Data Figures

B.1 Exploratory Stocks Data Graphs

The figures below depict combined line graphs of the opening, high, low, and closing prices of each stock in the alamSYS. These figures also demonstrate why closing prices were chosen as the primary training feature of the models developed for this particular problem. Aside from being the most important price target in most trading and investing strategies, closing prices do not differ significantly from the other price metrics.

Figure B.1: Opening, High, Low, and Closing Prices on AC

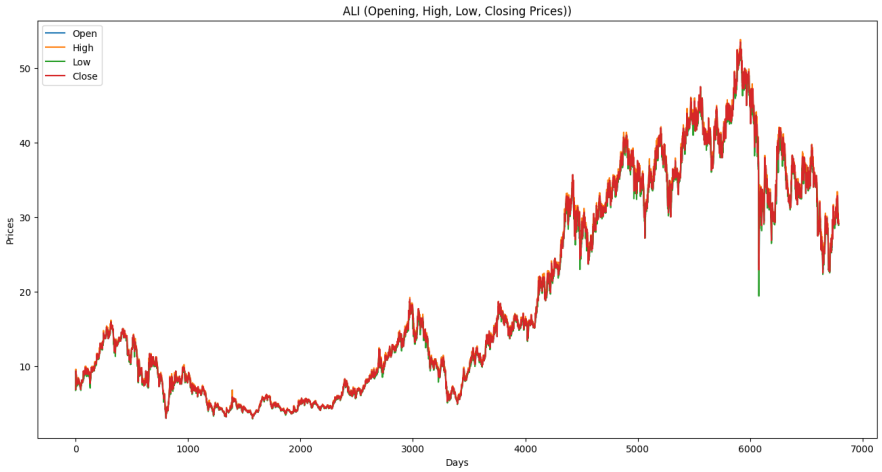


Figure B.2: Opening, High, Low, and Closing Prices for ALI

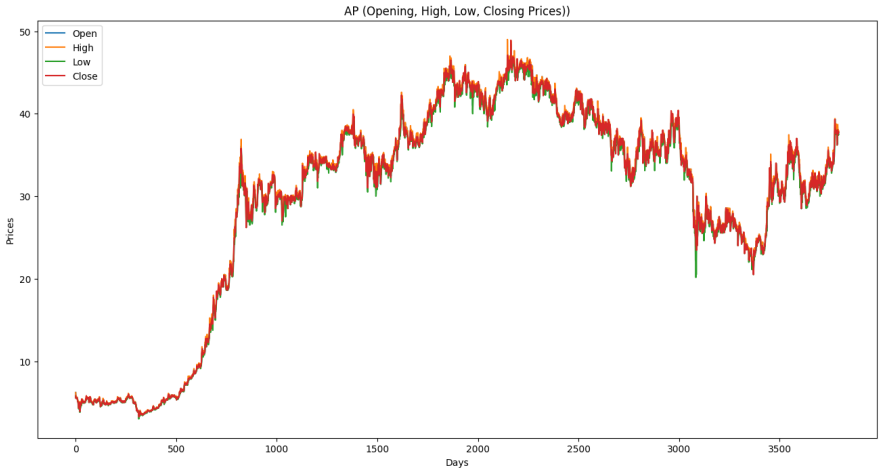


Figure B.3: Opening, High, Low, and Closing Prices for AP

Figure B.4: Opening, High, Low, and Closing Prices for BDO

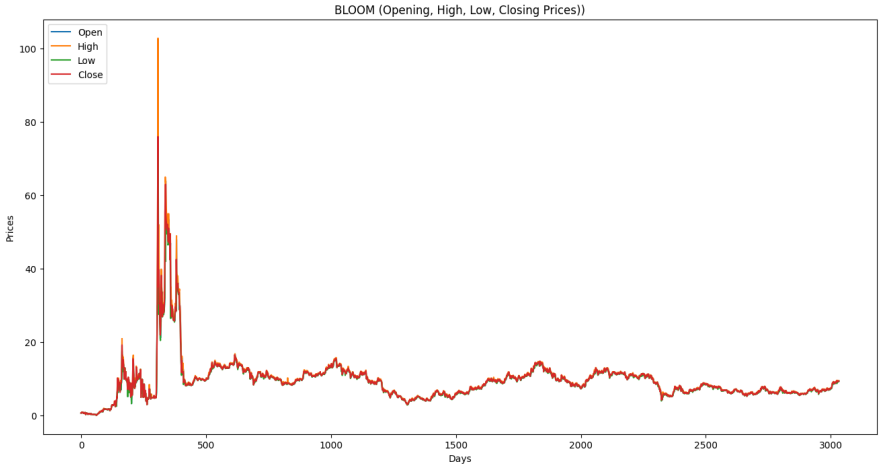


Figure B.5: Opening, High, Low, and Closing Prices for BLOOM

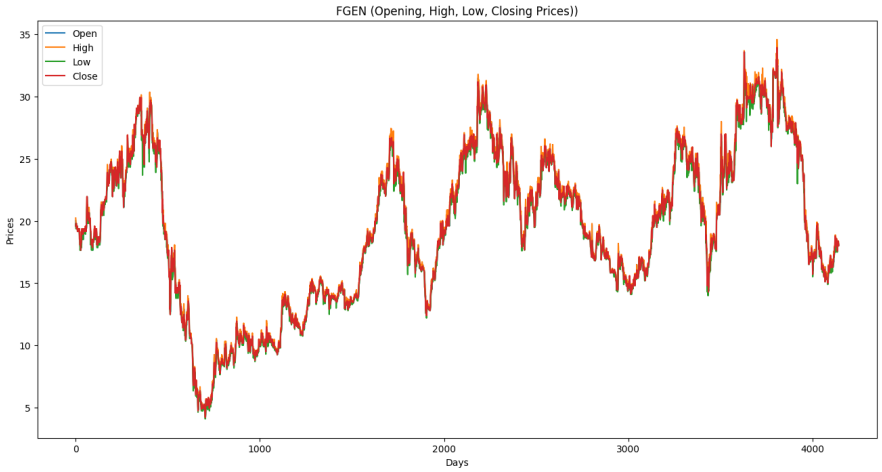


Figure B.6: Opening, High, Low, and Closing Prices for FGEN

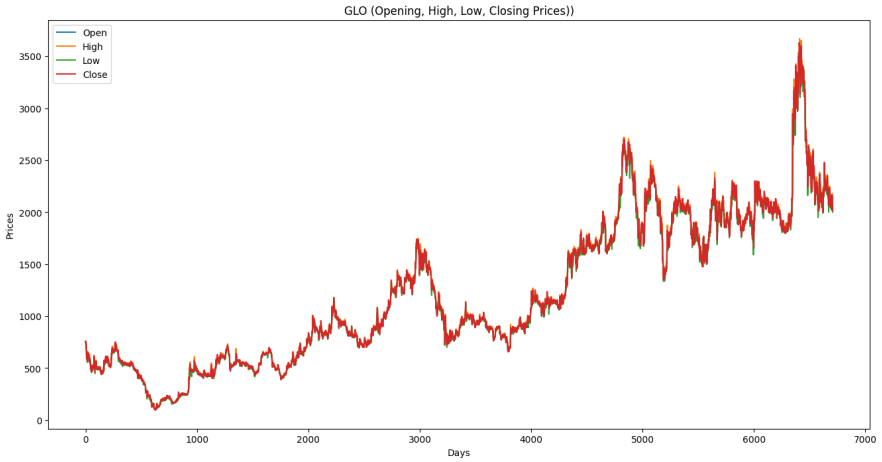


Figure B.7: Opening, High, Low, and Closing Prices for GLO

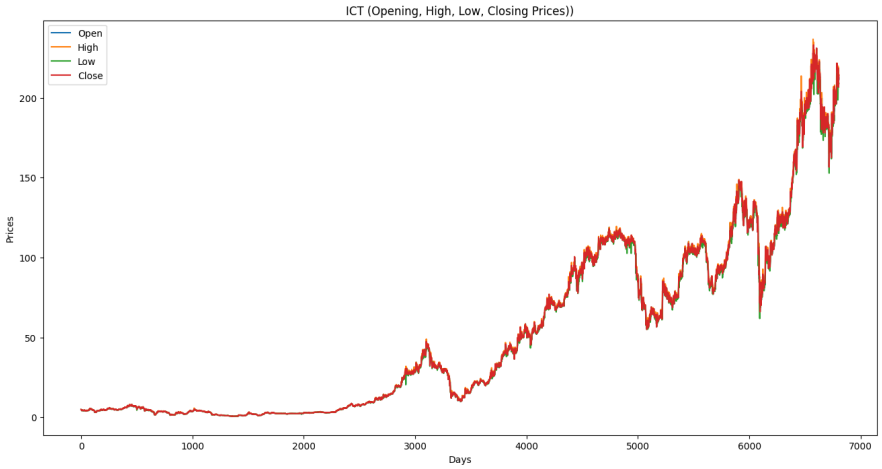


Figure B.8: Opening, High, Low, and Closing Prices for ICT

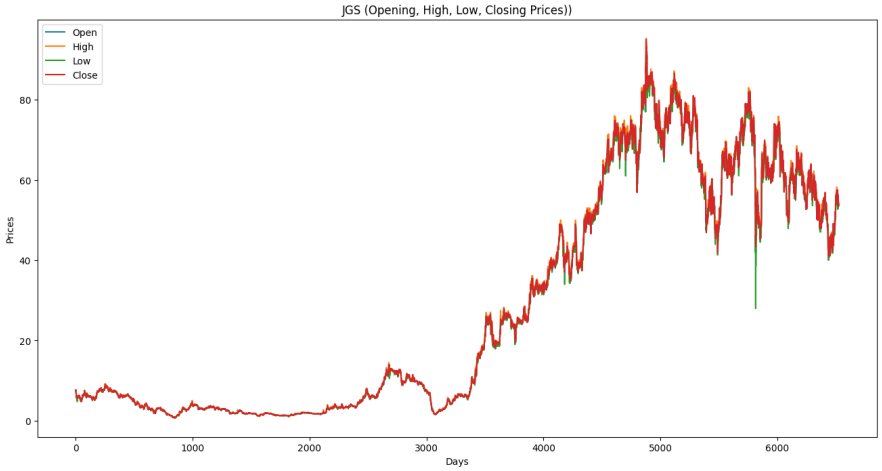


Figure B.9: Opening, High, Low, and Closing Prices on JGS

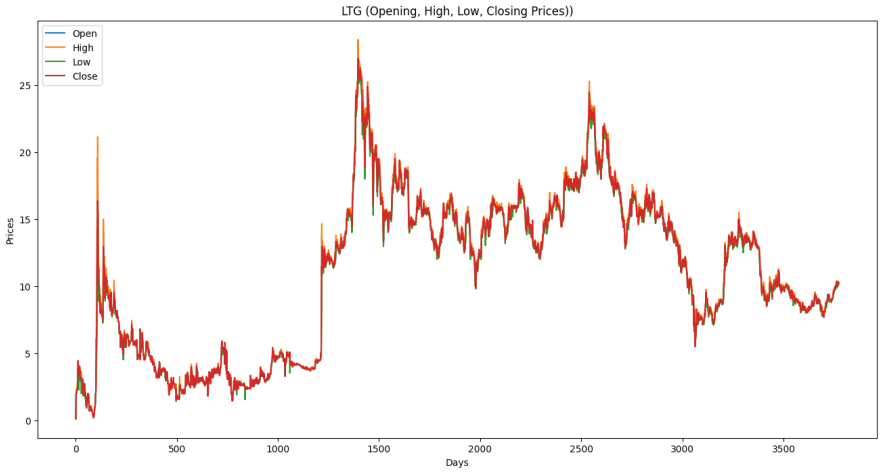


Figure B.10: Opening, High, Low, and Closing Prices on LTG

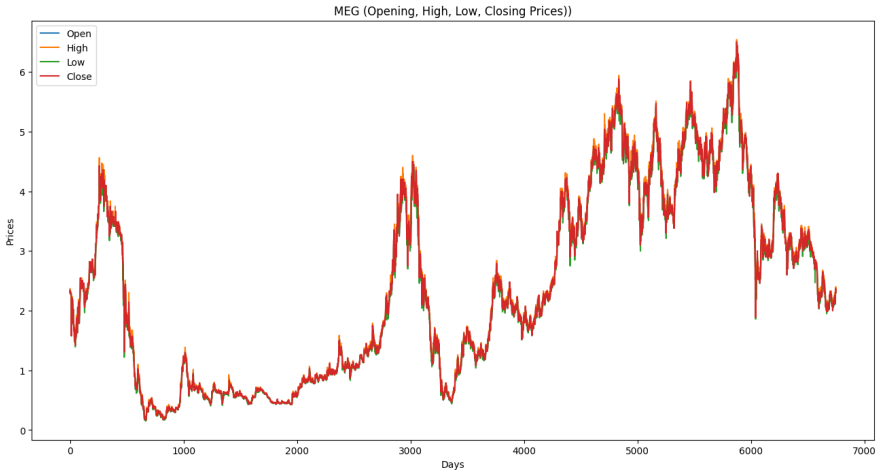


Figure B.11: Opening, High, Low, and Closing Prices on MEG

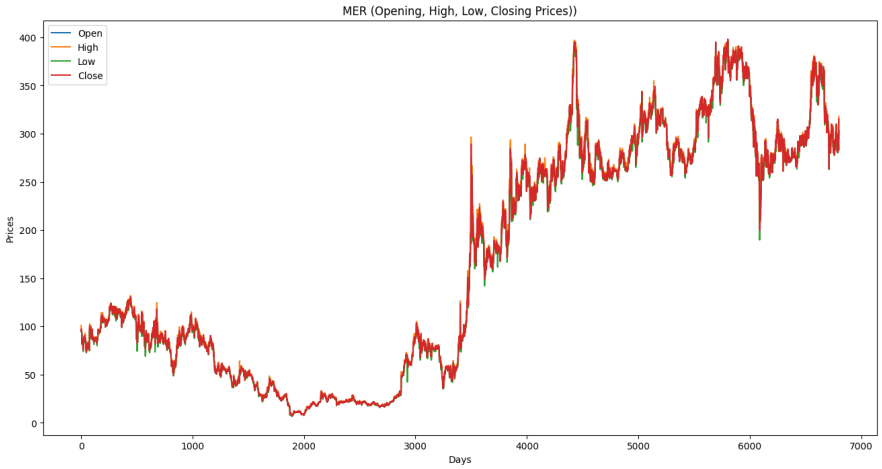


Figure B.12: Opening, High, Low, and Closing Prices on MER

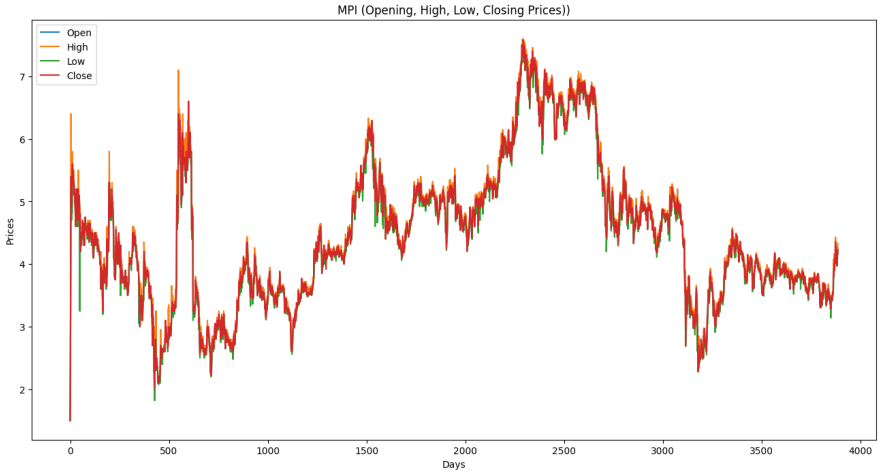


Figure B.13: Opening, High, Low, and Closing Prices on MPI

Figure B.14: Opening, High, Low, and Closing Prices on PGOLD

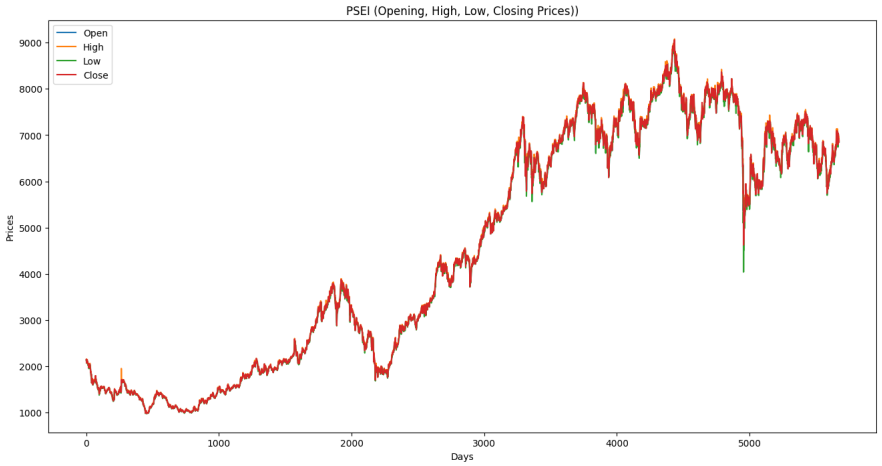


Figure B.15: Opening, High, Low, and Closing Prices on PSEI

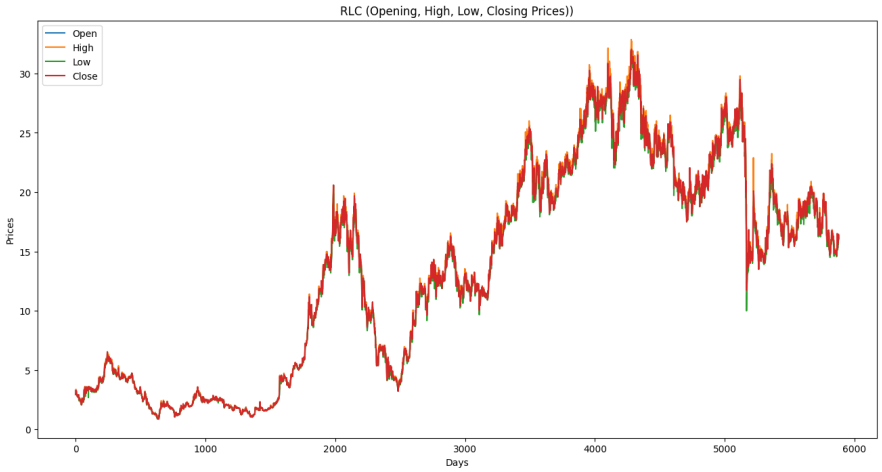


Figure B.16: Opening, High, Low, and Closing Prices on RLC

Figure B.17: Opening, High, Low, and Closing Prices on RRHI

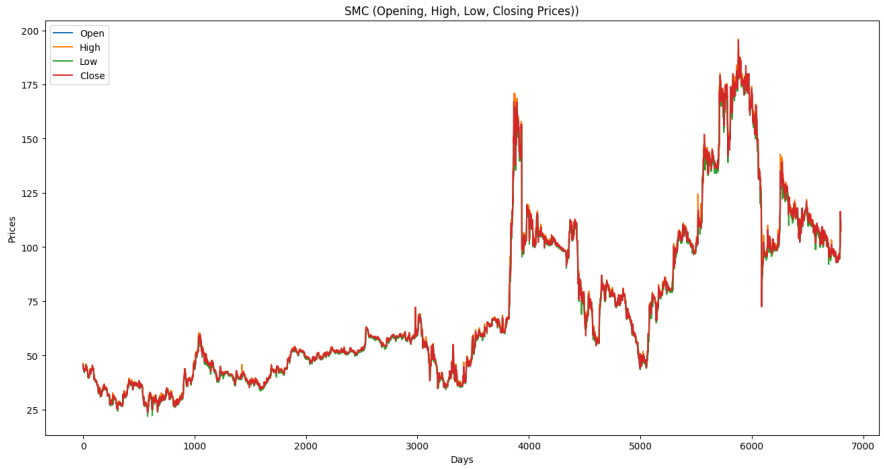


Figure B.18: Opening, High, Low, and Closing Prices on SMC

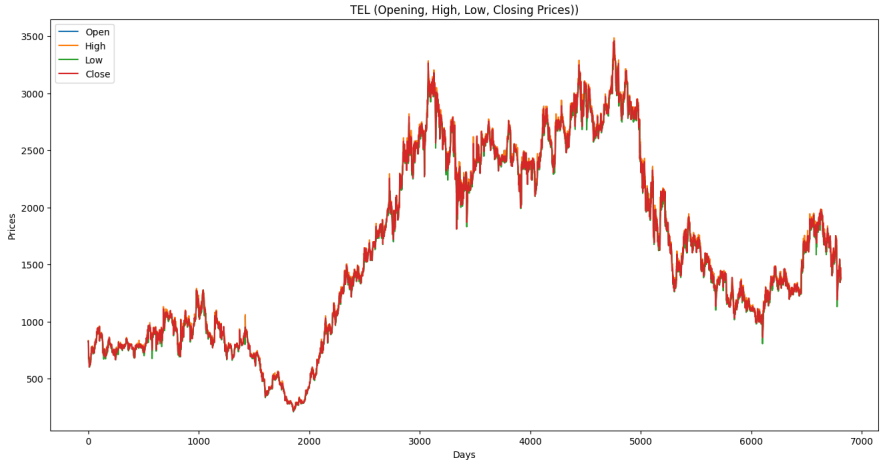


Figure B.19: Opening, High, Low, and Closing Prices on TEL

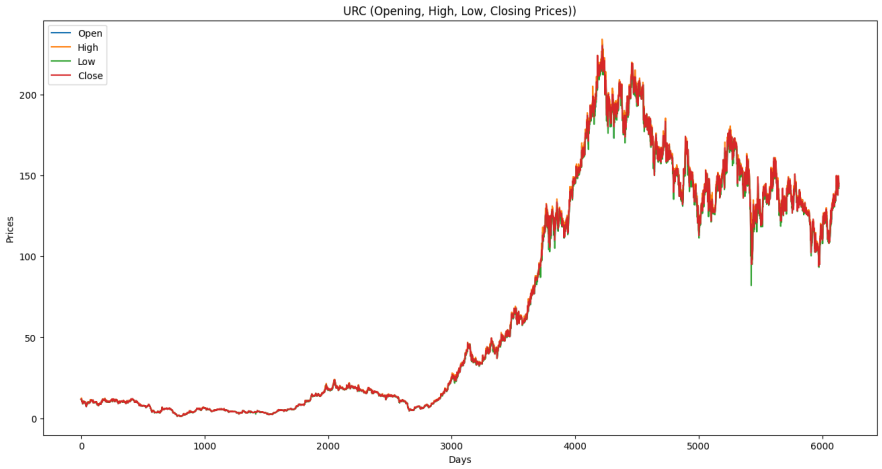


Figure B.20: Opening, High, Low, and Closing Prices on URC

B.2 Raw Model Testing and Cross-Validation Results

The loss metric scores for all eight models trained in this special problem are shown in the figures below.

model_baseline5.csv ×

```
,MSE,RMSE,MAE,MAPE
MEG,0.08072020880069887,0.2841130211741427,0.27684353215352125,1174375793447.243
JGS,0.07874435548854763,0.2806142467668875,0.27468463899133194,38927690524.79277
BDO,0.07657096858490822,0.27671459770837575,0.2738142088271028,0.07038134913330009
FGEN,0.07827957682896561,0.2797848759832554,0.2758278796079067,0.09700174437968641
ICT,0.0781394551452297,0.2795343541413643 5,0.2736751085473064,1438507573768.6584
ALI,0.0782312069917634,0.2796984215038823,0.27508077757070465,0.1147421270770546
SMC,0.07691227333252271,0.2773306209788647,0.27482445944890904,0.06707341533873201
TEL,0.07692274391391254,0.27734949777115614,0.2741700883069239,0.038119574269088366
GLO,0.07723200155169901,0.2779064618746729,0.27405219941941 21,0.040133964505169824
BLOOM,0.09321696719529625,0.3053145381328839 5,0.28594472341657 83,499188752957.71985
RLC,0.07891466401483171,0.2809175395286519,0.27499496364466064,0.2790370163068907
MER,0.07860945075825411,0.28037376974006345,0.2748269458519563,0.06180059505843166
AC,0.0775170120978667,0.2784187710946708,0.27419924809541 01,0.04794242756170382
PGOLD,0.07650623749204255,0.2765976093389864,0.2738838287046534,0.07546795486985015
LTG,0.09027857607286971,0.3004639347290614 7,0.2845669124314392,2960460439858.6323
MPI,0.07896762492375467,0.2810117878733109,0.2764535402803122,0.19535308715023528
AP,0.07613355995038901,0.2759231051405246 5,0.2735462968120787,0.09278031794532755
RRHI,0.07715208334861212,0.277762638503835,0.2753872091002812,0.06488774012116955
URC,0.07801107752908334,0.2793046321296575 6,0.2739888283647051,0.10613413435989405
PSEI,0.07615895487932436,0.2759691194306427 3,0.275949626259796,0.12659175356184194
```

Figure B.21: Raw Model Scores for Baseline 5

model_baseline10.csv ×

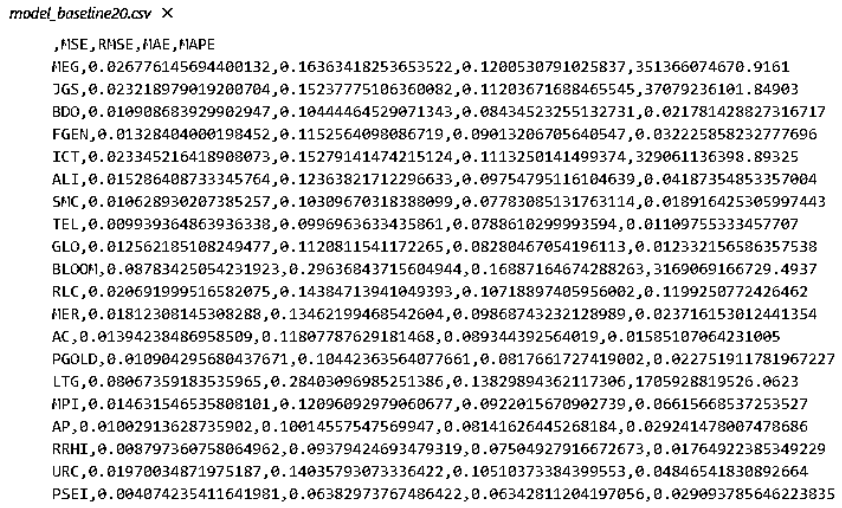
```
,MSE,RMSE,MAE,MAPE
MEG,0.009889911754036293,0.0994480354458362,0.06758199064508962,434720971982.4056
JGS,0.007846138726297082,0.08857843262497414,0.06152327438608147,85566335564.84262
BDO,0.0032789824378326032,0.05726239986092622,0.04134258195038248,0.010787188658697832
FGEN,0.004700003599831854,0.06855657225847755,0.04943646931664929 4,0.018101504501868163
ICT,0.007829080848597167,0.08848209337824896,0.05683387085820871,357524334780.4415
ALI,0.005405470132370961,0.07352190239901958,0.05348223646735878,0.023718671100290755
SMC,0.0032675047380823336,0.05716209179239624,0.03835913806689466,0.009415067971236714
TEL,0.003890710198736975,0.06237555770281317,0.046544974902766156,0.006570764404334346
GLO,0.004703932277881038,0.06858521909187895,0.04999657901879 6145,0.007451257567319880 5
BLOOM,0.04205391409035376 4,0.20507051004557864,0.10369141607734932,2475475634567.023
RLC,0.007579224342571167,0.08705874075916 31,0.05984216628062193,0.09443111972264119
MER,0.006914484697945786,0.08315338055632968,0.05643076670157 2516,0.013803759059196301
AC,0.004979648327052059,0.07056662332187973,0.05068551267808547,0.009095293073218335
PGOLD,0.003189631327437879 4,0.05647682115202554,0.042048119990808236,0.011758645358492095
LTG,0.03750821267854841,0.193670371194327,0.08933890463198181,3758594209106.506
MPI,0.005562216572904960 5,0.07458026932711466,0.04957733886385026,0.03681429790598718
AP,0.0025557353305988954,0.05055428103137157,0.03662417015508 0946,0.013458472431218822
RRHI,0.0028975891955775315,0.05382925966031422,0.04062648907853596 4,0.009641290779521416
URC,0.006889474338242650 5,0.08300285741010757,0.05719470539738885 6,0.028217183434511548
PSEI,9.232829705334228e-05,0.009608761473433623,0.00849409526375995 1,0.003899838261941660 3
```

Figure B.22: Raw Model Scores for Baseline 10

model_baseline15.csv ×

```
,MSE,RMSE,MAE,MAPE
MEG,0.034015743948385566,0.18443357597895663,0.15164354569027236,633909811283.2087
JGS,0.029592741877537167,0.17202541055767653,0.1445349665493625,8993505239.85993
BDO,0.020567719502463 94,0.14341450241333314,0.12778323238785438,0.03305043108059346
FGEN,0.024561083742794965,0.15671976181322816,0.13684348348281122,0.04888985126466148
ICT,0.028606631454426018,0.16913495042251325,0.13925183924528 6,961503494279.2739
ALI,0.024929240063415 44,0.15788996188300078,0.13549120794438474,0.05804993752172819
SMC,0.021793949272348297,0.14762773883098088,0.13474004267869616,0.03296828985038888
TEL,0.021478374677063 2,0.14655502269476 54,0.12978359047541 04,0.018121926611079 48
GLO,0.022966308778923 9,0.15154639150743213,0.13391374503363138,0.01978636490688916
BLOOM,0.07631830893786716,0.27625768575347 76,0.18855400548274345,53470633315 82.995
RLC,0.028379670384273657,0.16846266762779716,0.14320284147317 35,0.19419272464274054
MER,0.027250981000003 1,0.16507871152878284,0.14095218303137 07,0.032682665435146876
AC,0.023753398655402828,0.15412137637395673,0.13366109786697314,0.02360507100605 5328
PGOLD,0.020648336647877637,0.14369529097321748,0.12934035195131813,0.035568815339653496
LTG,0.07658990441865482,0.27674881105192634,0.17747568634736 15,2504326275497.088
MPI,0.026182659841909636,0.16181056776956 7,0.14017747870431393,0.10104140736854278
AP,0.019192122314937974,0.13853563554168283,0.12615347917006875,0.04275891022501 5656
RRHI,0.021215358356749883,0.14565492905065,0.13197476027457852,0.03120428832678116
URC,0.026784860024530 64,0.16366080784516077,0.13675722964040252,0.05989435898919455
PSEI,0.017520964135483975,0.13236677882113765,0.13221706472713188,0.06066009164259066
```

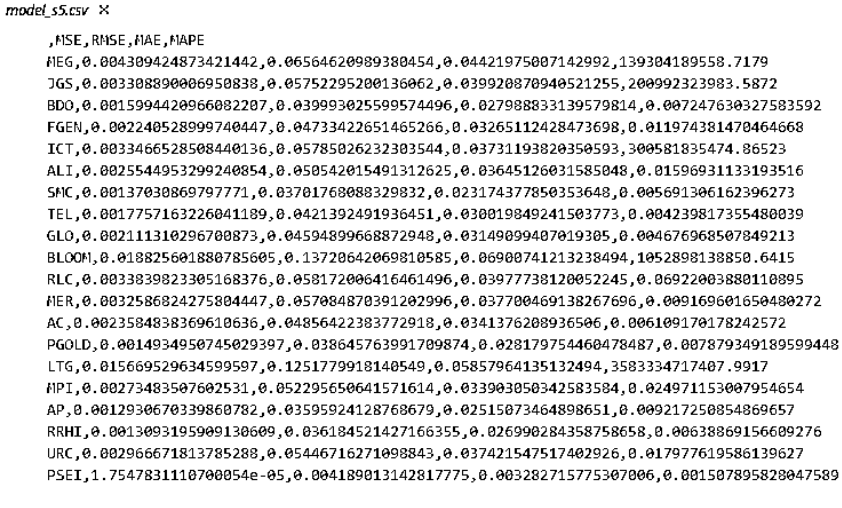
Figure B.23: Raw Model Scores for Baseline 15



model_baseline20.csv ×

,MSE,RMSE,MAE,MAPE
MEG,0.026776145694400132,0.16363418253653522,0.1200530791025837,351366074670.9161
JGS,0.023218979019200704,0.15237775106360082,0.11203671688465545,37079236101.84903
BDO,0.010908683929902947,0.10444464529071343,0.08434523255132731,0.021781428827316717
FGEN,0.013284040000198452,0.1152564098086719,0.09013206705640547,0.032225858232777696
ICT,0.02334521641890807 3,0.1527914147421 5124,0.1113250141499374,329061136398.89325
ALI,0.01528640873334 5764,0.12363821712296633,0.09754795116104639,0.04187354853357004
SMC,0.010628930207385257,0.10309670318388099,0.07783085131763114,0.018916425305997443
TEL,0.009939364863936338,0.0996963633435861,0.0788610299993594,0.01109755333457707
GLO,0.012562185108249477,0.1120811541172265,0.08280467054196113,0.012332156586357538
BLOOM,0.08783425054231923,0.29636843715604944,0.16887164674288263,3169069166729.4937
RLC,0.020691999516582075,0.14384713941049393,0.10718897405956002,0.1199250772426462
MER,0.018123081453082 88,0.13462199468542604,0.09868743232128989,0.023716153012441354
AC,0.01394238486958509,0.11807787629181468,0.089344392564019,0.01585107064231005
PGOLD,0.010904295680437671,0.10442363564077661,0.08176617274190 02,0.022751911781967227
LTG,0.08067359183535965,0.28403096985251386,0.13829894362117306,1705928819526.0623
MPI,0.014631546535808101,0.12096092979060677,0.092201567090 2739,0.06615668537253527
AP,0.010029136287359 02,0.10014557547569947,0.08141626445268184,0.029241478007478686
RRHI,0.008797360758064962,0.09379424693479319,0.07504927916672673,0.01764922385349229
URC,0.01970034871975187,0.14035793073336422,0.10510373384399553,0.04846541830892664
PSEI,0.004074235411641981,0.06382973767486422,0.06342811204197056,0.029093785646223835

Figure B.24: Raw Model Scores for Baseline 20



model_s5.csv ×

,MSE,RMSE,MAE,MAPE
MEG,0.004309424873421442,0.06564620989380454,0.04421975007142992,139304189558.7179
JGS,0.003308890006950838,0.05752295200136062,0.03992087094052 1255,200992323983.5872
BDO,0.001599442096660820 7,0.03999302559957 4496,0.027988833139579814,0.007247630327583592
FGEN,0.002240528999740447,0.04733422651465266,0.03265112428473698,0.011974381470464668
ICT,0.003346652850844013 6,0.05785026232303544,0.03731193820350593,300581835474.86523
ALI,0.002554495329924085 4,0.05054201549131 2625,0.03645126031585048,0.01596931133193516
SMC,0.00137030869797771,0.03701768088329832,0.02317437785035364 8,0.005691306162396273
TEL,0.001775716322604118 9,0.04213924919364 51,0.03001984924150377 3,0.004239817355480039
GLO,0.002111310296700873,0.04594899668872948,0.03149099407019305,0.004676968507849213
BLOOM,0.018825601880785605,0.13720642069810585,0.06900741213238494,1052898138850.6415
RLC,0.003383982330516837 6,0.05817200641646149 6,0.03977738120052245,0.06922003880110895
MER,0.003258682427580444 7,0.05708487039120 2996,0.03770046913826 7696,0.009169601650480272
AC,0.002358483836961063 6,0.04856422383772918,0.03413762089365 06,0.006109170178242572
PGOLD,0.001493495074502939 7,0.03864576399170 9874,0.028179754460478487,0.007879349189599448
LTG,0.015669529634599597,0.1251779918140549,0.0585796413513249 4,3583334717407.9917
MPI,0.00273483507602531,0.05229565064157 1614,0.03390305034258358 4,0.024971153007954654
AP,0.001293067033986078 2,0.03595924128768679,0.02515073464898651,0.009217250854869657
RRHI,0.001309319590913060 9,0.03618452142716635 5,0.026990284358758658,0.00638869156609276
URC,0.002966718137852 88,0.05446716271098843,0.03742154751740292 6,0.017977619586139627
PSEI,1.754783111070005 4e-05,0.004189013142817775,0.003282715775307006,0.001507895828047589

Figure B.25: Raw Model Scores for DMD-LSTM 5

model_s10.csv ×

```
,MSE,RMSE,MAE,MAPE
MEG,0.009865752600343098,0.09932649495649737,0.06737299027636771,435734064705.6676
JGS,0.007845334501853743,0.08857389289092889,0.06135788509350167,103893946584.96439
BDO,0.00327995409232174,0.05727088346028669,0.0413452891693641,0.010743648101452627
FGEN,0.004617395242386965,0.06795141825147556,0.048889136842270545,0.017866975592035
ICT,0.007884621330086128,0.08879539025200649,0.057237276691394216,320809756127.44025
ALI,0.005390492967401505,0.07341997662354234,0.05328993535240997,0.023548819706954743
SMC,0.00318771840654004 8,0.05645988316087847,0.03586861396100476,0.00880857357236526
TEL,0.0036866145213750832,0.060717497654095426,0.04474277319282044,0.006319036216914404
GLO,0.004552884186453377,0.06747506344164025,0.047282846382667394,0.007046825769159827 5
BLOOM,0.04206409341784911,0.20509532763534402,0.10301736984181184,2396590596797.983
RLC,0.007585752882284707,0.0870962277155831,0.059771887078320866,0.09172759091241212
MER,0.006828068233221027,0.08263212591493109,0.055823760181086673,0.013659473951391473
AC,0.004871472887048709,0.06979593746808412,0.04979303078429352,0.008922829587183788
PGOLD,0.0031831479163302 52,0.056419393087220035,0.04133830254008775,0.011574060171746585
LTG,0.037464440033346064,0.19355733009458997,0.08800307126114834,3804223137493.905
MPI,0.005520841190178309,0.07430236328797564,0.0492521638149232,0.03649038768402956
AP,0.0026026827963171323,0.05101649533550038,0.036747169289 1345,0.013583309298257755
RRHI,0.0027778499369829 22,0.05270531222735449,0.03922510794653118,0.009295106895914377
URC,0.006898006661078345,0.08305423927216686,0.057343117943704225,0.02816949652429363
PSEI,4.0854336533939 71e-05,0.006391739711059 87,0.004984381407170562,0.002288420978937786
```

Figure B.26: Raw Model Scores for DMD-LSTM 10

model_s15.csv ×

```
,MSE,RMSE,MAE,MAPE
MEG,0.015632947601103515,0.1250317863629226,0.08599908102247829,282985182400.4937
JGS,0.012964389929998767,0.11386127493576895,0.07835242363030513,109315071771.05272
BDO,0.004860908219981323,0.06972021385495976,0.05080170327959182,0.013273483429938518
FGEN,0.006962947850480 0255,0.08344427991468334,0.06153289935423559,0.022449511828279718
ICT,0.013007479593210832,0.1140503379793801,0.07292148376731492,396061318234.26843
ALI,0.00810466519619875,0.09002591402590007,0.066367103228538,0.029520448994738713
SMC,0.005101124231403319,0.07142215504591919,0.04582754439638881,0.011229080466157778
TEL,0.005439188193806359,0.07375085215647585,0.05519736046986012,0.007819104873858874
GLO,0.007018476178400337,0.08377634617480245,0.05858766515961793,0.008779822537746144
BLOOM,0.06054300374145961,0.24605487953190364,0.13095504115084 76,5900492566389.731
RLC,0.011676685314347363,0.10805871234818303,0.07540320907116821,0.11945476091327935
MER,0.010688164462570354,0.10338357926948726,0.07023073059770062,0.017282976093600 01
AC,0.007595390918192069,0.0871515399645472,0.061456889302250 37,0.011039297095713095
PGOLD,0.004859201309319683,0.06970797163395076,0.05122762443858 43,0.014339564237239416
LTG,0.05808674831062965,0.24101192566059806,0.10807781590206503,2316692766061.9355
MPI,0.008080401796946723,0.0898910551553753,0.06020282472442268,0.04473013446882734
AP,0.0038632369071855297,0.06215494274139049,0.04434230453119878,0.016505958531928256
RRHI,0.004132716283832857,0.06428620601523205,0.04803456414328379,0.011401074357359176
URC,0.010867588278427435,0.10424772553119534,0.07207244516575859,0.03624692811649131 4
PSEI,3.912591469048572e-05,0.006255071117939885,0.004142081727067567,0.001904601646476297 7
```

Figure B.27: Raw Model Scores for DMD-LSTM 15

model_s20.csv ×

,MSE,RMSE,MAE,MAPE
MEG,0.022323896742406167,0.14941183601845662,0.10290009425682627,266729753264.34708
JGS,0.018713341878839475,0.13679671735403404,0.09445716160359285,33462393302.143425
BDO,0.006756430654995097,0.08219751002916753,0.060170842223956744,0.015760545579428267
FGEN,0.009597141213378582,0.09796499994068587,0.07234479676026784,0.026376477197220943
ICT,0.01852442554536271,0.13610446555996136,0.0884036204475373,501915336431.2399
ALI,0.011079138682075038,0.10525748753449816,0.07817609171626877,0.034775151593376956
SMC,0.007048757669965641,0.08395687982509617,0.054683683815575 4,0.013374177511788293
TEL,0.007329064462734207,0.08560995539500185,0.06517997383340782,0.009244621847414265
GLO,0.009758692882070095,0.09878609660306502,0.06921019624724692,0.01039521403335 6167
BLOOM,0.08238165998516955,0.2870220548758745 7,0.1577616055528068,3419715539589.91
RLC,0.01615196335933326,0.1270903747706067,0.08988687939937239,0.12828506623288913
MER,0.01468617694758008,0.12118653781497382,0.08247620417598935,0.020392816829558198
AC,0.010767353439365156,0.10376585873670181,0.0724461701452523 8,0.013014703427266284
PGOLD,0.006606336237122399,0.08127937153498666,0.06071069833794954,0.016982336902546864
LTG,0.07756279210367704,0.2785009732544521,0.12605638618291093,1762772789831.8323
MPI,0.010612065609680215,0.10301488052548 63,0.06982793923155896,0.05185919561554108
AP,0.005253278055885270 5,0.07247950093568023,0.05175236778740295,0.01929521473466818 2
RRHI,0.005486993480023987 5,0.07407424302700627,0.05646758054206 36,0.013389493057254155
URC,0.015310641590353787,0.12373617737086348,0.0868352222276058,0.04379474785289333
PSEI,7.322582229059844e-05,0.008557208790873 25,0.006455499639920296,0.0029648261136105067

Figure B.28: Raw Model Scores for DMD-LSTM 20

B.3 Model Testing Raw Test Results for DMD-LSTM

The graphs below show the performance of the different DMD-LSTM models trained in the conduct of this special problem based on the test data split of PSEI.

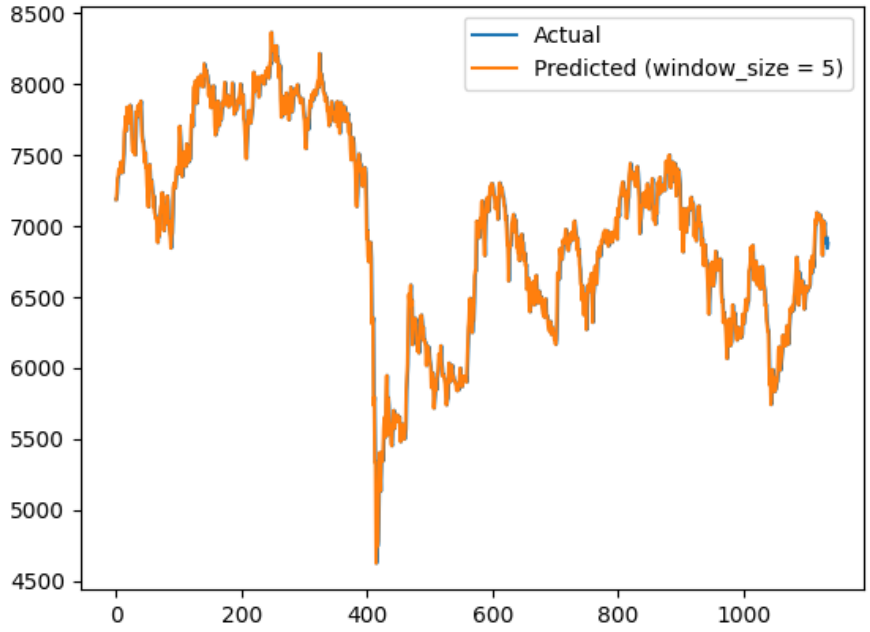


Figure B.29: Actual vs Predicted Closing Prices for DMD-LSTM 5 (Using Train Data from PSEI)

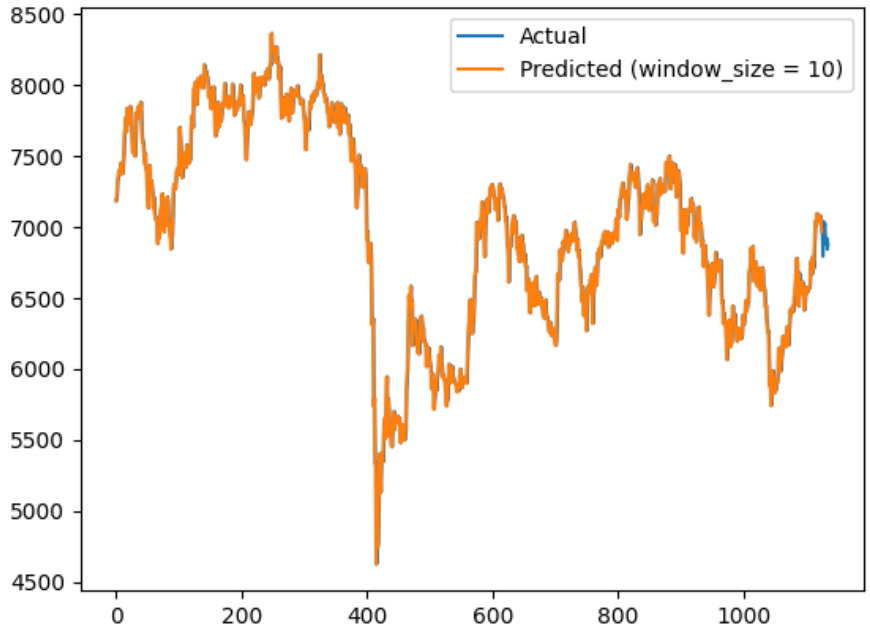


Figure B.30: Actual vs Predicted Closing Prices for DMD-LSTM 10 (Using Train Data from PSEI)

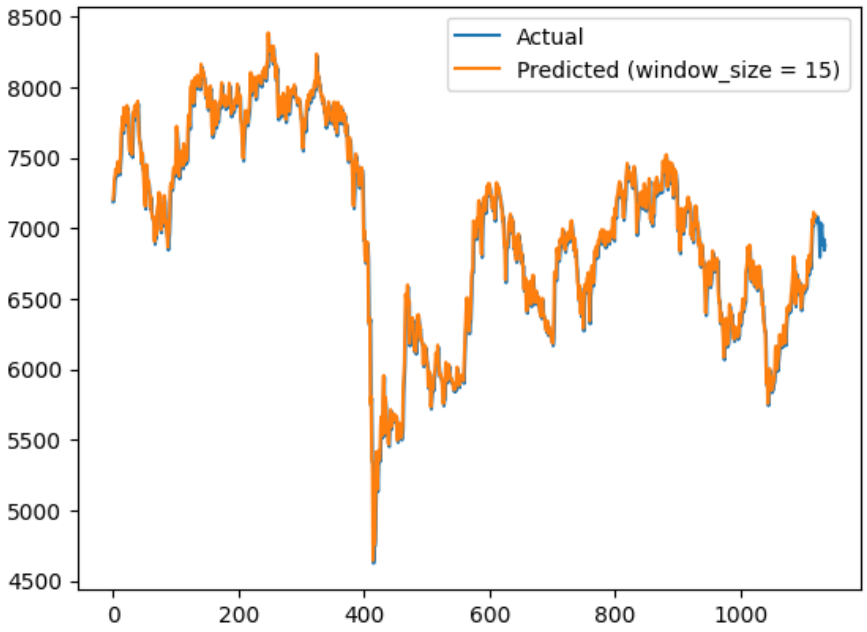


Figure B.31: Actual vs Predicted Closing Prices for DMD-LSTM 15 (Using Train Data from PSEI)

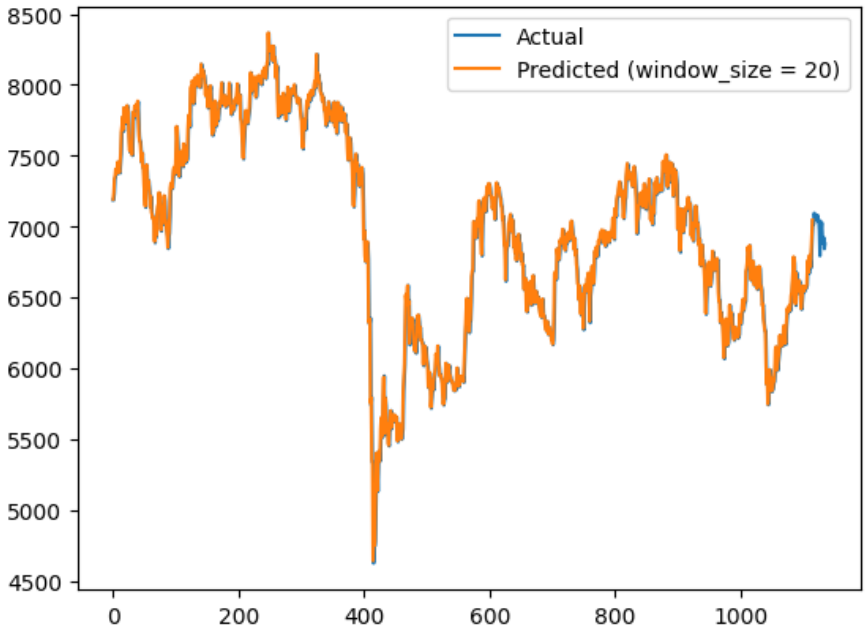


Figure B.32: Actual vs Predicted Closing Prices for DMD-LSTM 20 (Using Train Data from PSEI)

B.4 Daily Return Distribution of the Different Stocks

Figures below show the daily return distribution of each stock, which was used to calculate each stock's risk profile.

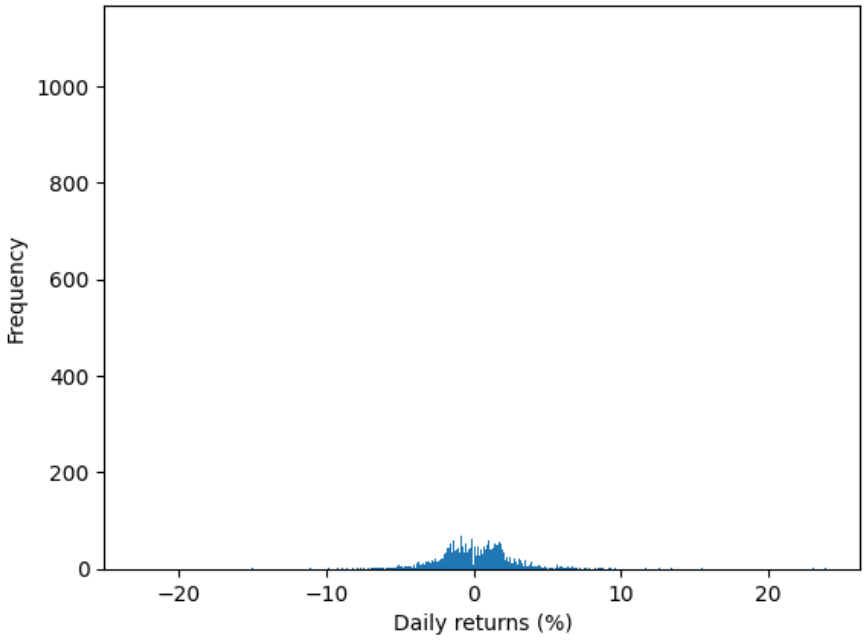


Figure B.33: Daily Return Distribution of AC

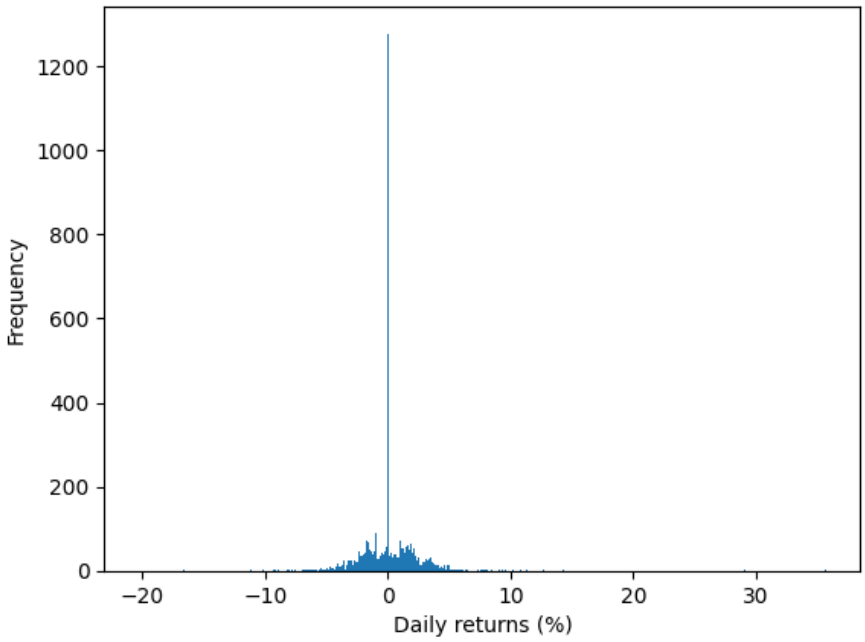


Figure B.34: Opening, High, Low, and Closing Prices for ALI

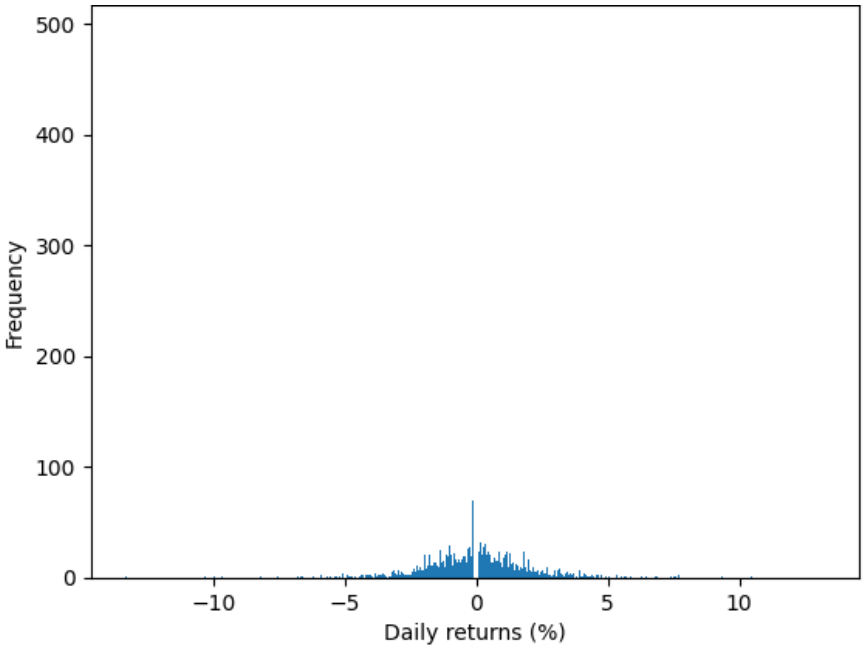


Figure B.35: Opening, High, Low, and Closing Prices for AP

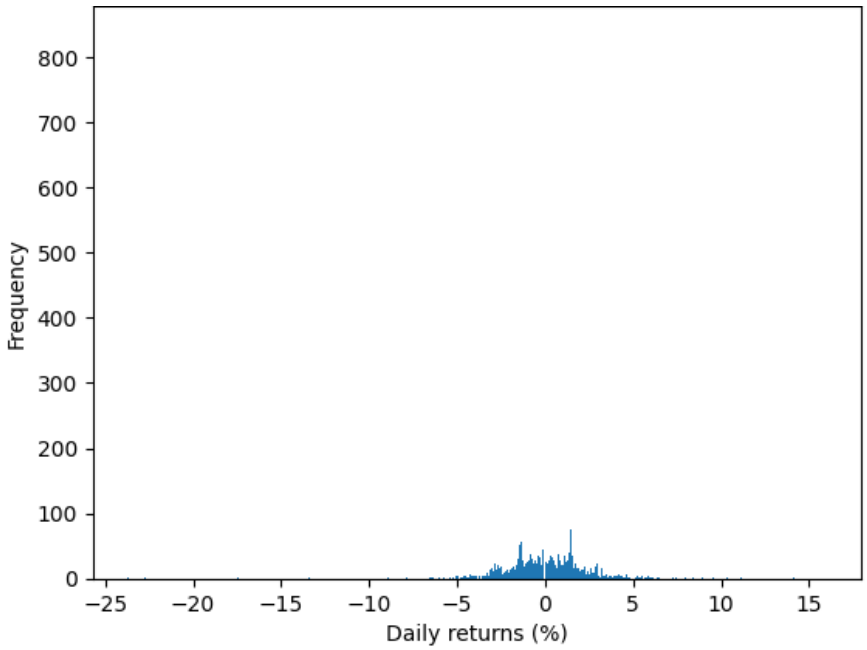


Figure B.36: Opening, High, Low, and Closing Prices for BDO

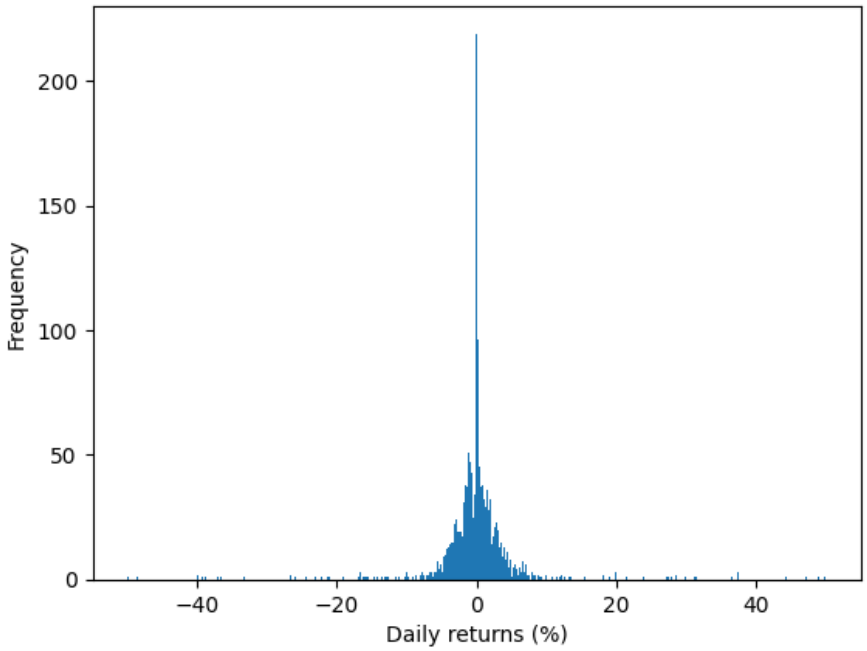


Figure B.37: Opening, High, Low, and Closing Prices for BLOOM

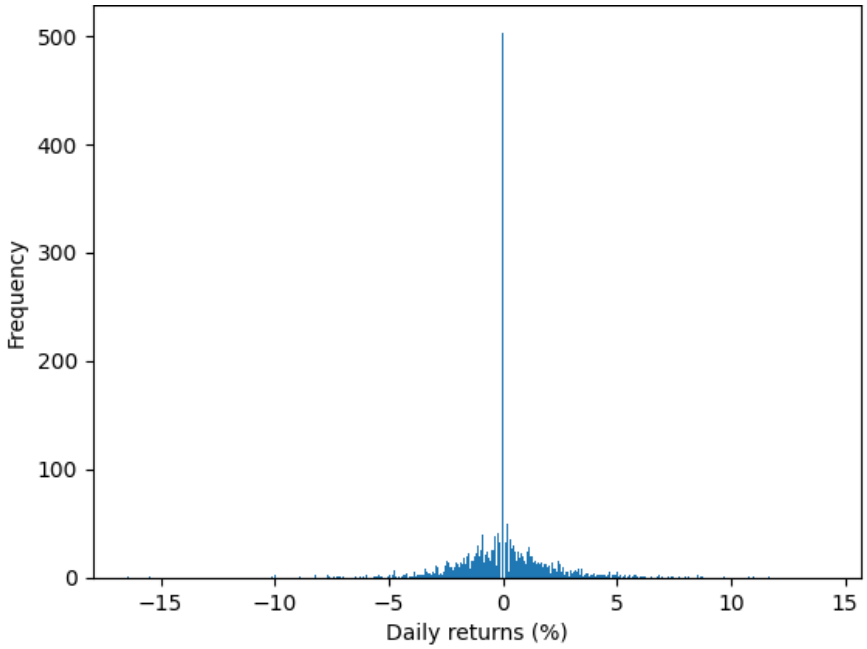


Figure B.38: Opening, High, Low, and Closing Prices for FGEN

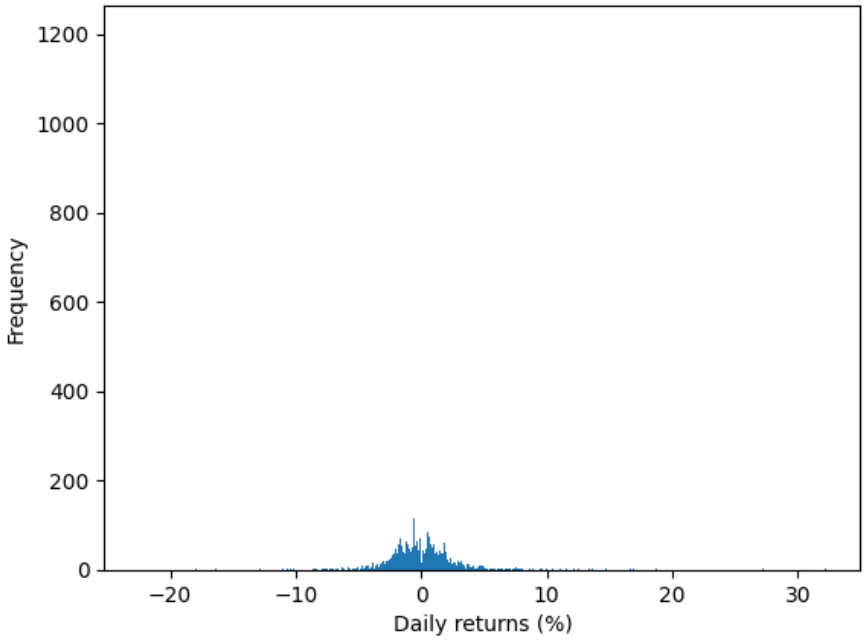


Figure B.39: Opening, High, Low, and Closing Prices for GLO

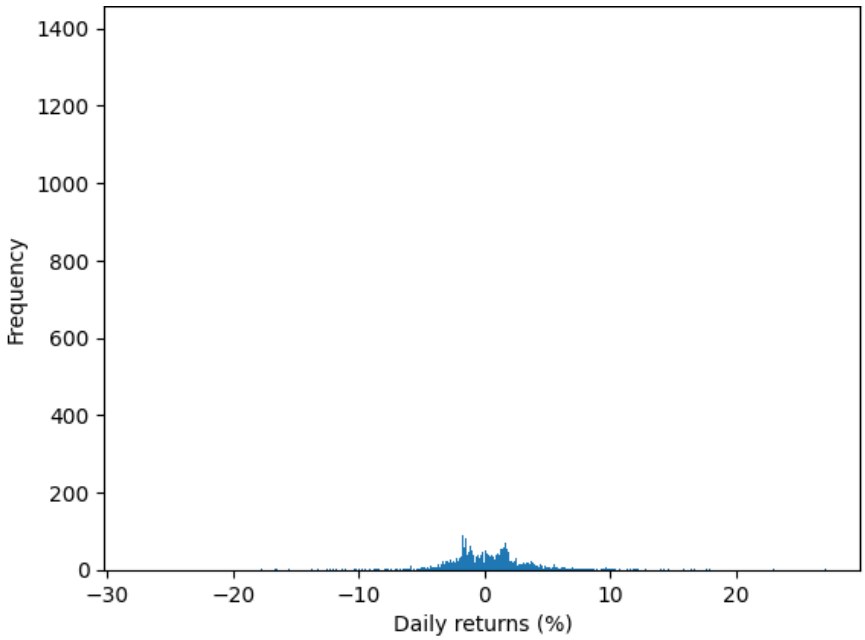


Figure B.40: Opening, High, Low, and Closing Prices for ICT

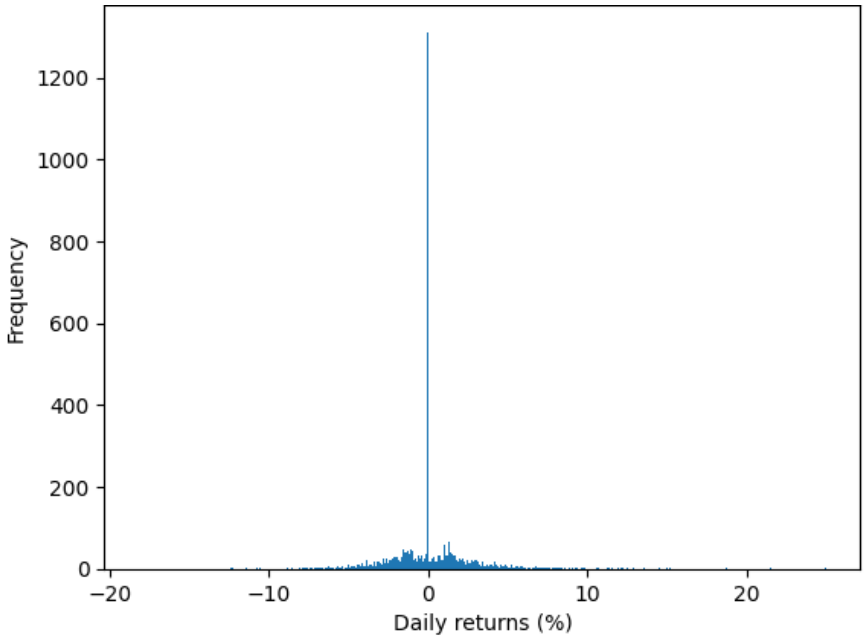


Figure B.41: Daily Return Distribution of JGS

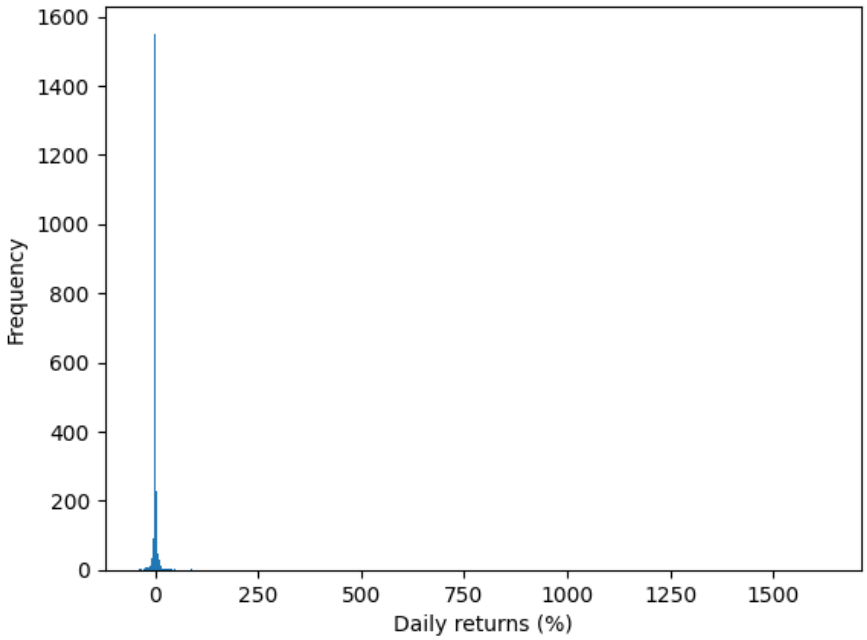


Figure B.42: Daily Return Distribution of LTG

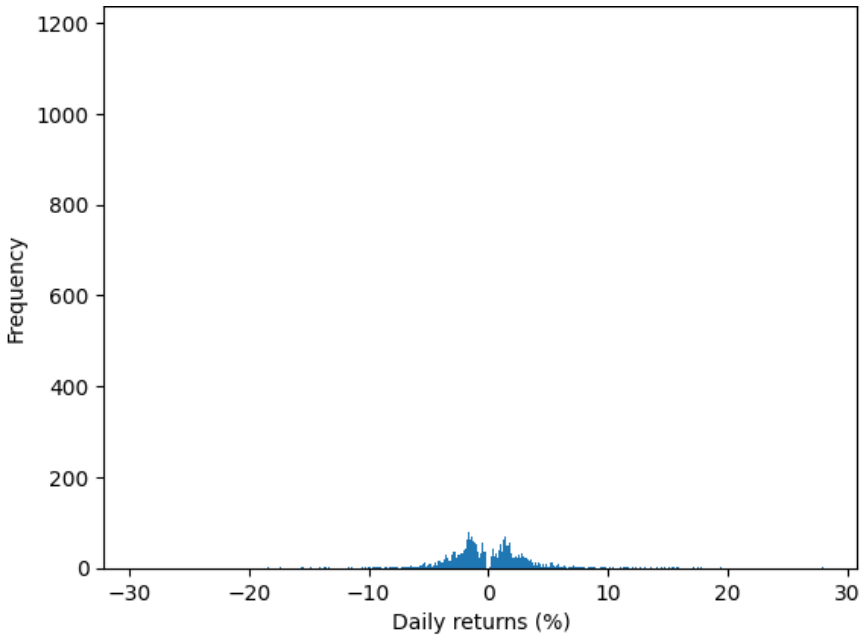


Figure B.43: Daily Return Distribution of MEG

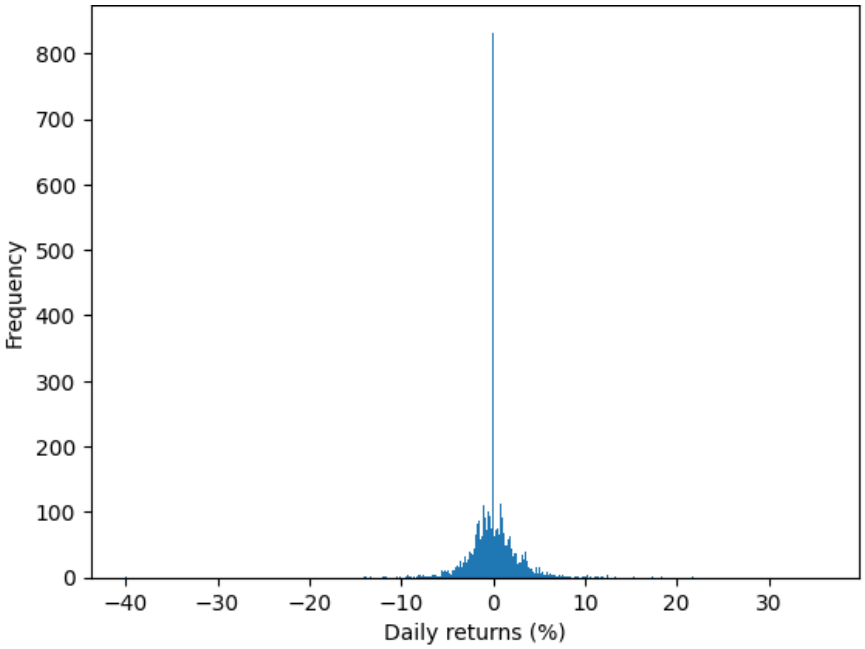


Figure B.44: Daily Return Distribution of MER

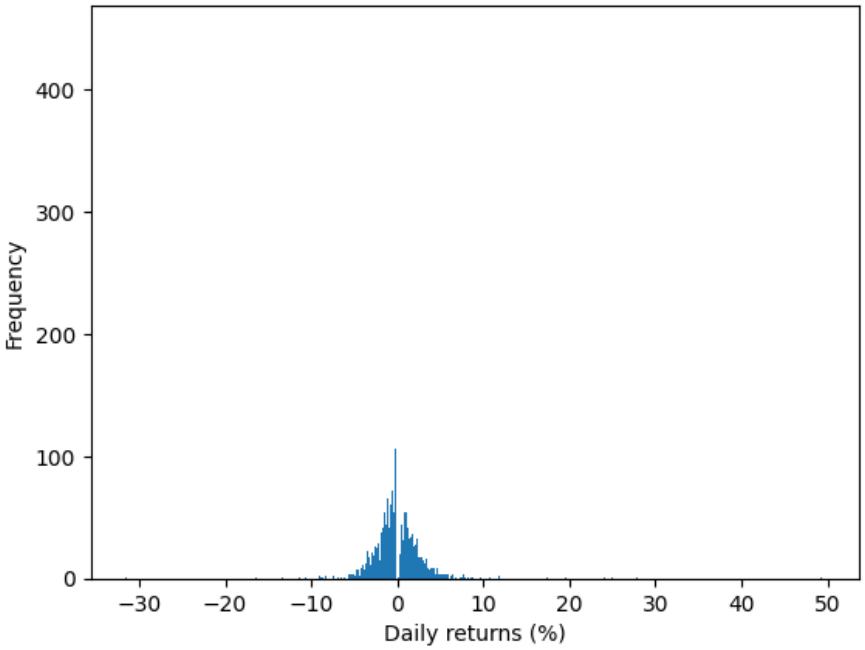


Figure B.45: Daily Return Distribution of MPI

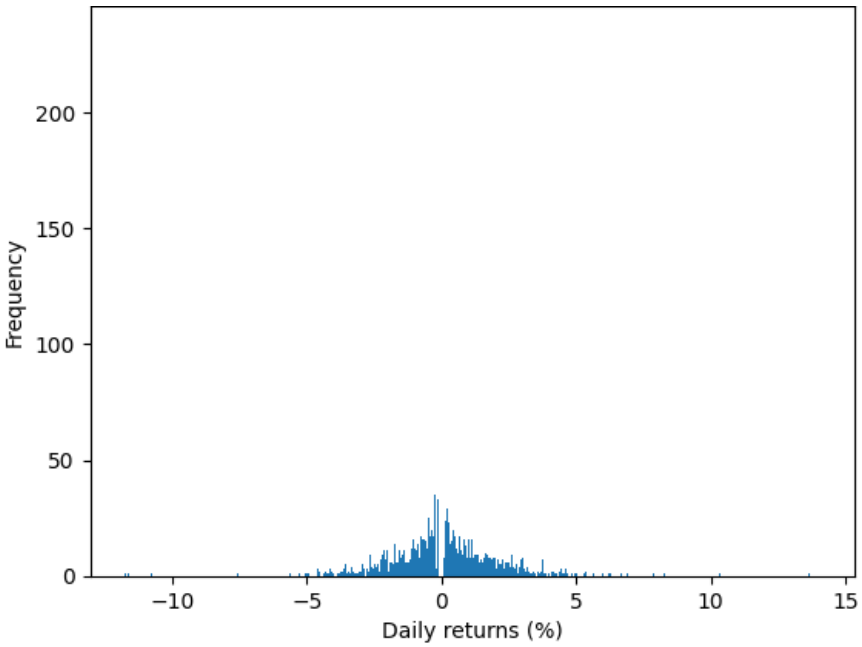


Figure B.46: Daily Return Distribution of PGOLD

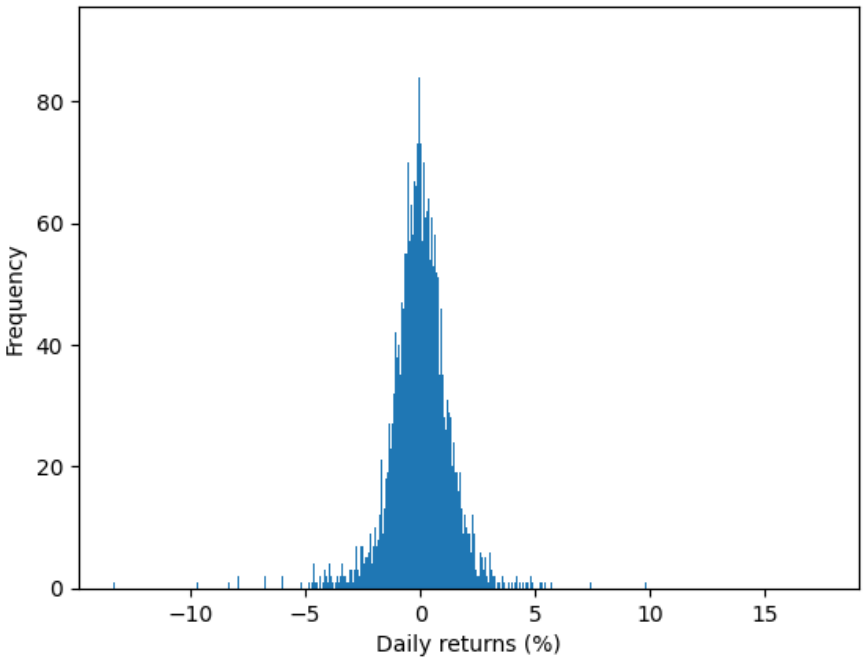


Figure B.47: Daily Return Distribution of PSEI

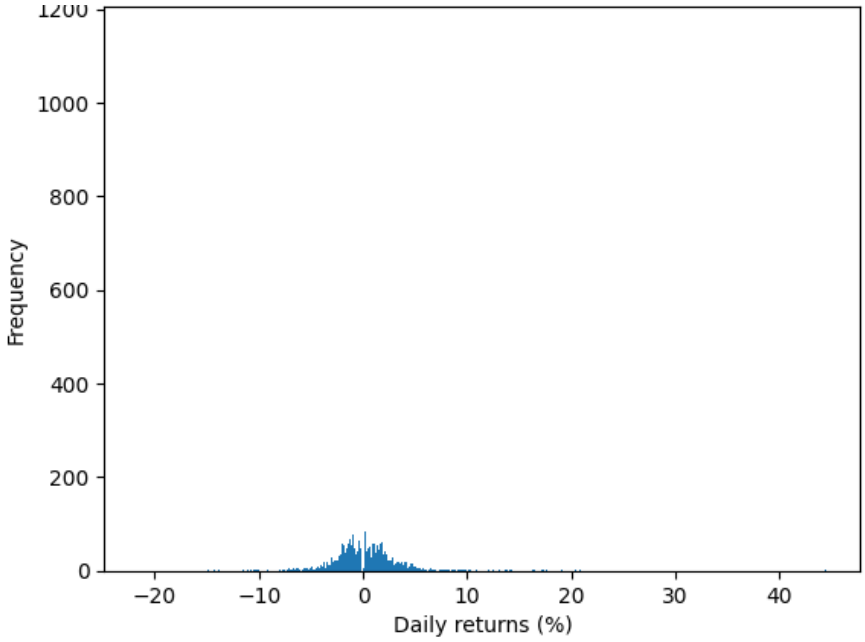


Figure B.48: Daily Return Distribution of RLC

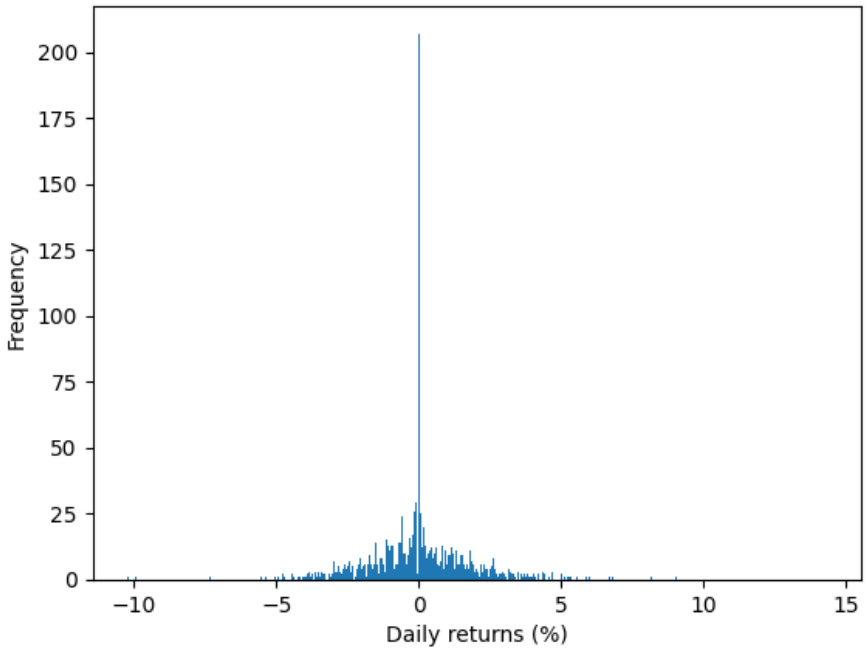


Figure B.49: Daily Return Distribution of RRHI

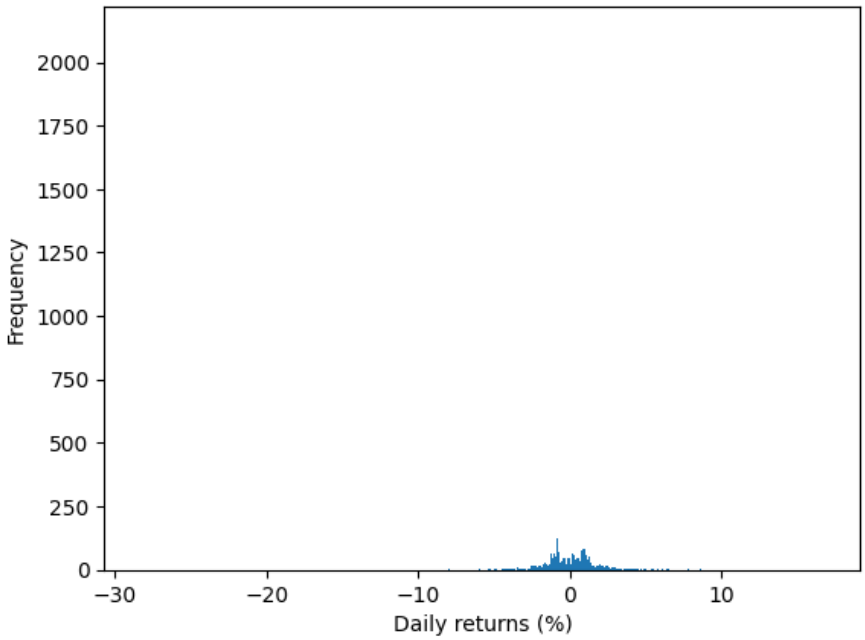


Figure B.50: Daily Return Distribution of SMC

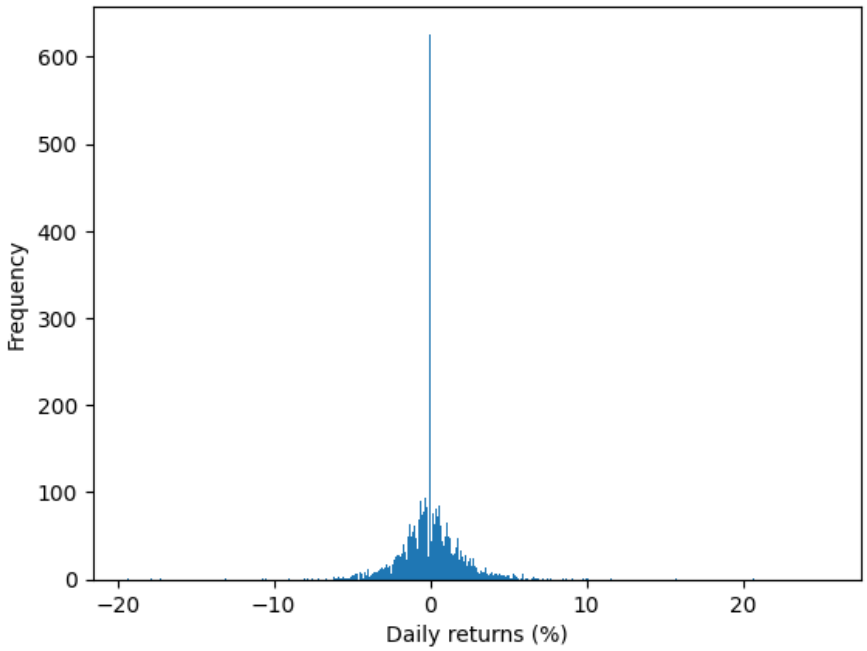


Figure B.51: Daily Return Distribution of TEL

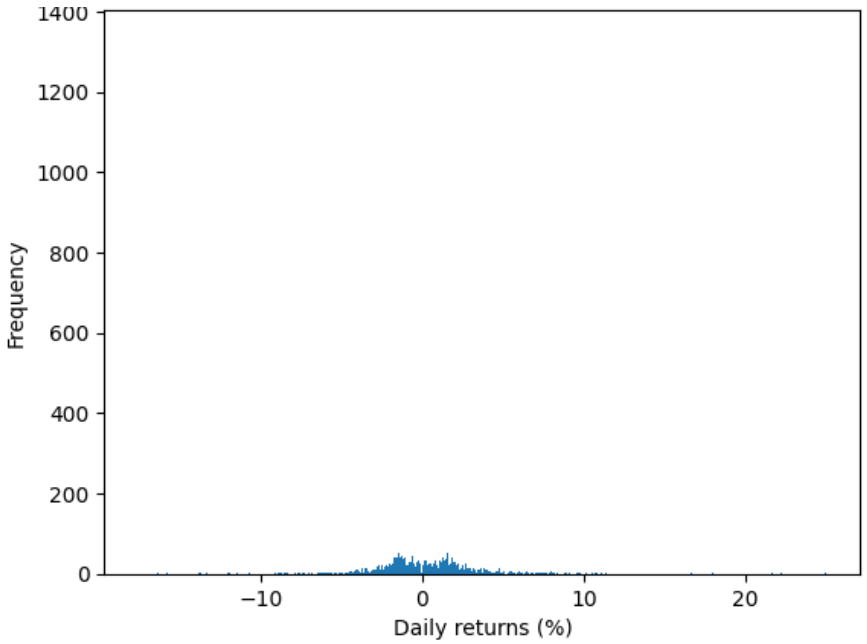


Figure B.52: Daily Return Distribution of URC

stock	value_at_risk%	volatility%	drawdown%	start_date	end_date
MEG	-5.365715	3.949969	57.248140	2000-01-03	2023-02-10
JGS	-4.762357	3.361099	43.184044	2000-01-03	2023-02-10
BDO	-3.302488	2.364049	39.670648	2000-01-03	2023-02-10
FGEN	-3.819079	2.559254	30.604259	2000-01-03	2023-02-10
ICT	-4.827050	3.520840	54.645013	2000-01-03	2023-02-10
ALI	-4.390485	3.070487	56.026166	2000-01-03	2023-02-10
SMC	-3.403674	2.385956	45.298783	2000-01-03	2023-02-10
TEL	-3.693763	2.460023	44.659116	2000-01-03	2023-02-10
GLO	-4.120044	3.092601	54.758065	2000-01-03	2023-02-10
BLOOM	-5.984996	7.061554	100.000000	2000-01-03	2023-02-10
RLC	-4.529364	3.416989	65.982906	2000-01-03	2023-02-10
MER	-4.498595	3.254736	76.000028	2000-01-03	2023-02-10
AC	-4.290654	2.796171	46.688827	2000-01-03	2023-02-10
PGOLD	-3.114919	2.134819	25.799794	2000-01-03	2023-02-10
LTG	-6.153221	31.223317	1667.806911	2000-01-03	2023-02-10
MPI	-4.055836	3.499676	81.132519	2000-01-03	2023-02-10
AP	-3.197641	2.187289	26.540881	2000-01-03	2023-02-10
RRHI	-3.032063	2.053932	24.509668	2000-01-03	2023-02-10
URC	-4.532392	3.199716	42.542617	2000-01-03	2023-02-10
PSEI	-1.887800	1.318818	30.903657	2000-01-03	2023-02-10

Figure B.53: Raw Risk Profile Scores

B.5 Raw alamSYS Test Data

This section is divided into three sections: raw system logs, PSEI trading baseline data, and raw real-world alamSYS application.

B.5.1 Raw System Logs

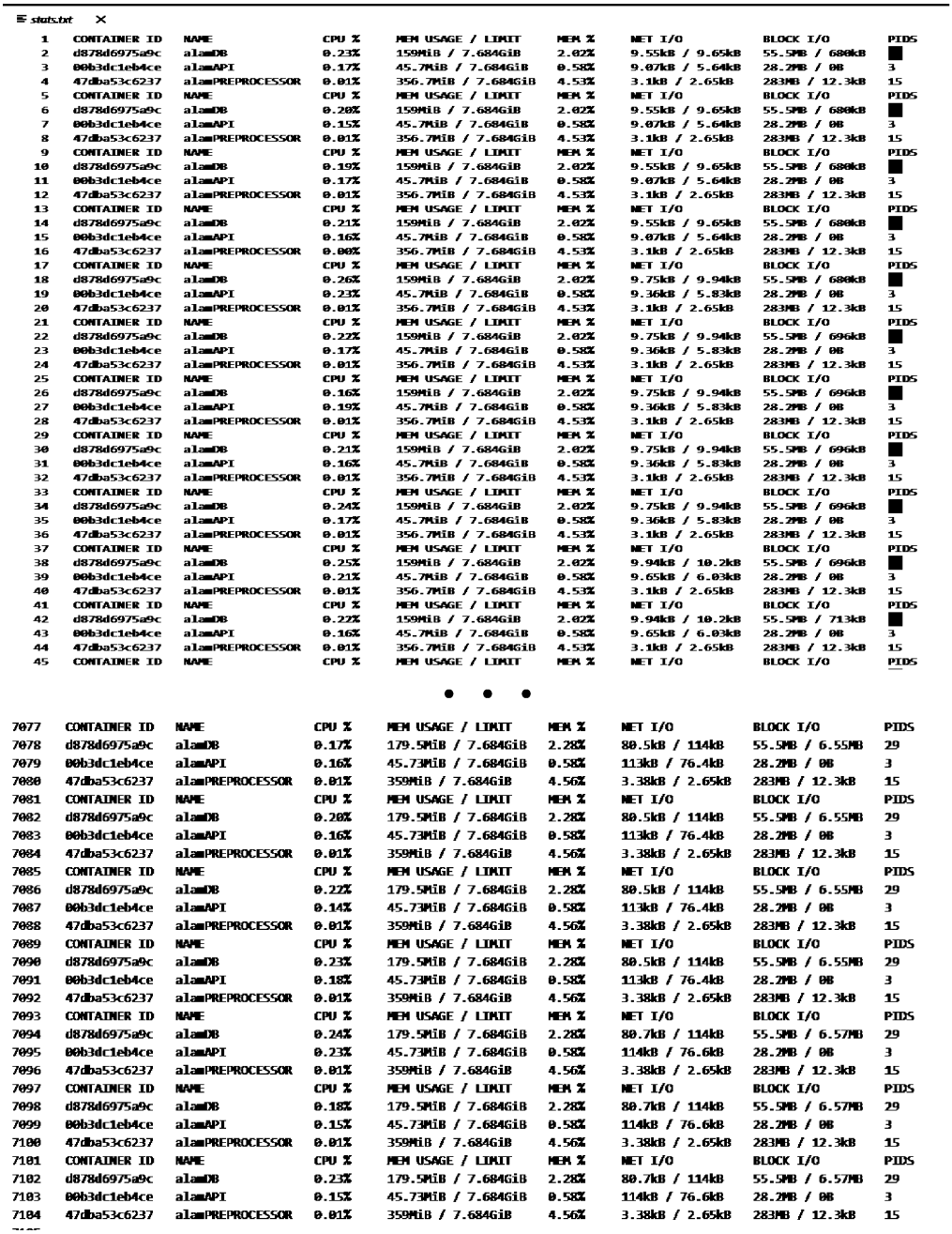


Figure B.54: Raw Logs of Idle System Statistics

```
1   CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
2   e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
3   f73c98947a50   alamAPI2              2.30%     44.24MiB / 7.684GiB   0.56%     60.1kB / 39.2kB   0B / 0B     3
4   daf25cdfc1f2   alamDB2               0.32%     122MiB / 7.684GiB     1.55%     42.5kB / 57.8kB   0B / 0B     29
5   CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6   e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
7   f73c98947a50   alamAPI2              27.35%    45.62MiB / 7.684GiB   0.58%     286kB / 273kB     0B / 0B     12
8   daf25cdfc1f2   alamDB2               1.54%     122.4MiB / 7.684GiB   1.56%     64.8kB / 187kB    0B / 0B     36
9   CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
10  e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
11  f73c98947a50   alamAPI2              31.85%    45.65MiB / 7.684GiB   0.58%     531kB / 526kB     0B / 0B     12
12  daf25cdfc1f2   alamDB2               1.61%     122.4MiB / 7.684GiB   1.56%     85.1kB / 329kB    0B / 0B     36
13  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
14  e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
15  f73c98947a50   alamAPI2              30.66%    45.96MiB / 7.684GiB   0.58%     800kB / 808kB     0B / 0B     12
16  daf25cdfc1f2   alamDB2               1.61%     122.4MiB / 7.684GiB   1.56%     108kB / 491kB     0B / 0B     36
17  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
18  e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
19  f73c98947a50   alamAPI2              24.59%    45.96MiB / 7.684GiB   0.58%     1MB / 1.02MB      0B / 0B     12
20  daf25cdfc1f2   alamDB2               1.32%     122.4MiB / 7.684GiB   1.56%     125kB / 610kB     0B / 0B     36
21  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
22  e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
23  f73c98947a50   alamAPI2              28.89%    45.96MiB / 7.684GiB   0.58%     1.23MB / 1.25MB   0B / 0B     12
24  daf25cdfc1f2   alamDB2               1.51%     122.4MiB / 7.684GiB   1.56%     145kB / 744kB     0B / 0B     36
25  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
26  e6af858e1766   alamPREPROCESSOR2     0.01%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
27  f73c98947a50   alamAPI2              29.01%    45.98MiB / 7.684GiB   0.58%     1.5MB / 1.54MB    0B / 0B     11
28  daf25cdfc1f2   alamDB2               1.72%     122.4MiB / 7.684GiB   1.56%     169kB / 914kB     0B / 0B     36
29  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
30  e6af858e1766   alamPREPROCESSOR2     0.02%     294.6MiB / 7.684GiB   3.74%     3.45kB / 2.65kB   0B / 0B     8
31  f73c98947a50   alamAPI2              23.69%    45.93MiB / 7.684GiB   0.58%     1.68MB / 1.73MB   0B / 0B     11
32  daf25cdfc1f2   alamDB2               1.23%     122.4MiB / 7.684GiB   1.56%     184kB / 1.02MB    0B / 0B     36
```

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6908  daf25cdfc1f2   alamDB2               0.30%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6909  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6910  e6af858e1766   alamPREPROCESSOR2     0.01%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6911  f73c98947a50   alamAPI2              0.20%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6912  daf25cdfc1f2   alamDB2               0.71%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6913  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6914  e6af858e1766   alamPREPROCESSOR2     0.01%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6915  f73c98947a50   alamAPI2              0.18%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6916  daf25cdfc1f2   alamDB2               0.19%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6917  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6918  e6af858e1766   alamPREPROCESSOR2     0.01%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6919  f73c98947a50   alamAPI2              0.24%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6920  daf25cdfc1f2   alamDB2               0.49%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6921  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6922  e6af858e1766   alamPREPROCESSOR2     0.02%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6923  f73c98947a50   alamAPI2              0.28%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6924  daf25cdfc1f2   alamDB2               0.31%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6925  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6926  e6af858e1766   alamPREPROCESSOR2     0.01%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6927  f73c98947a50   alamAPI2              0.25%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6928  daf25cdfc1f2   alamDB2               0.28%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
6929  CONTAINER ID   NAME                  CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O   PIDS
6930  e6af858e1766   alamPREPROCESSOR2     0.01%     296.6MiB / 7.684GiB   3.77%     3.59kB / 2.65kB   0B / 0B     8
6931  f73c98947a50   alamAPI2              0.18%     45.76MiB / 7.684GiB   0.58%     273MB / 293MB     0B / 0B     4
6932  daf25cdfc1f2   alamDB2               0.46%     145.6MiB / 7.684GiB   1.85%     21.2MB / 178MB    0B / 0B     41
```

Figure B.55: Raw Logs of Deployment System Statistics

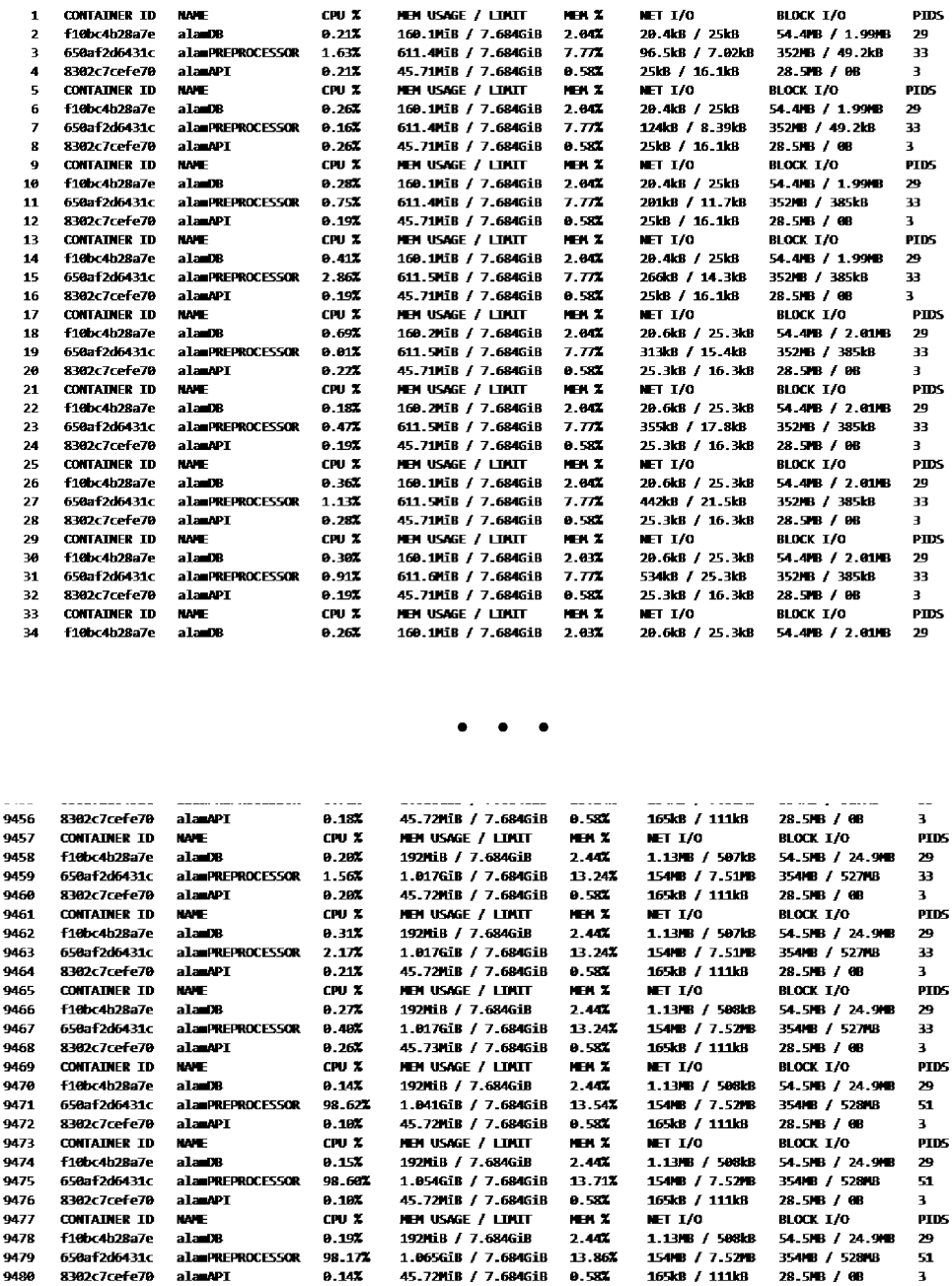

Figure B.56: Raw Logs of Data Collector Module (DCM) System Statistics

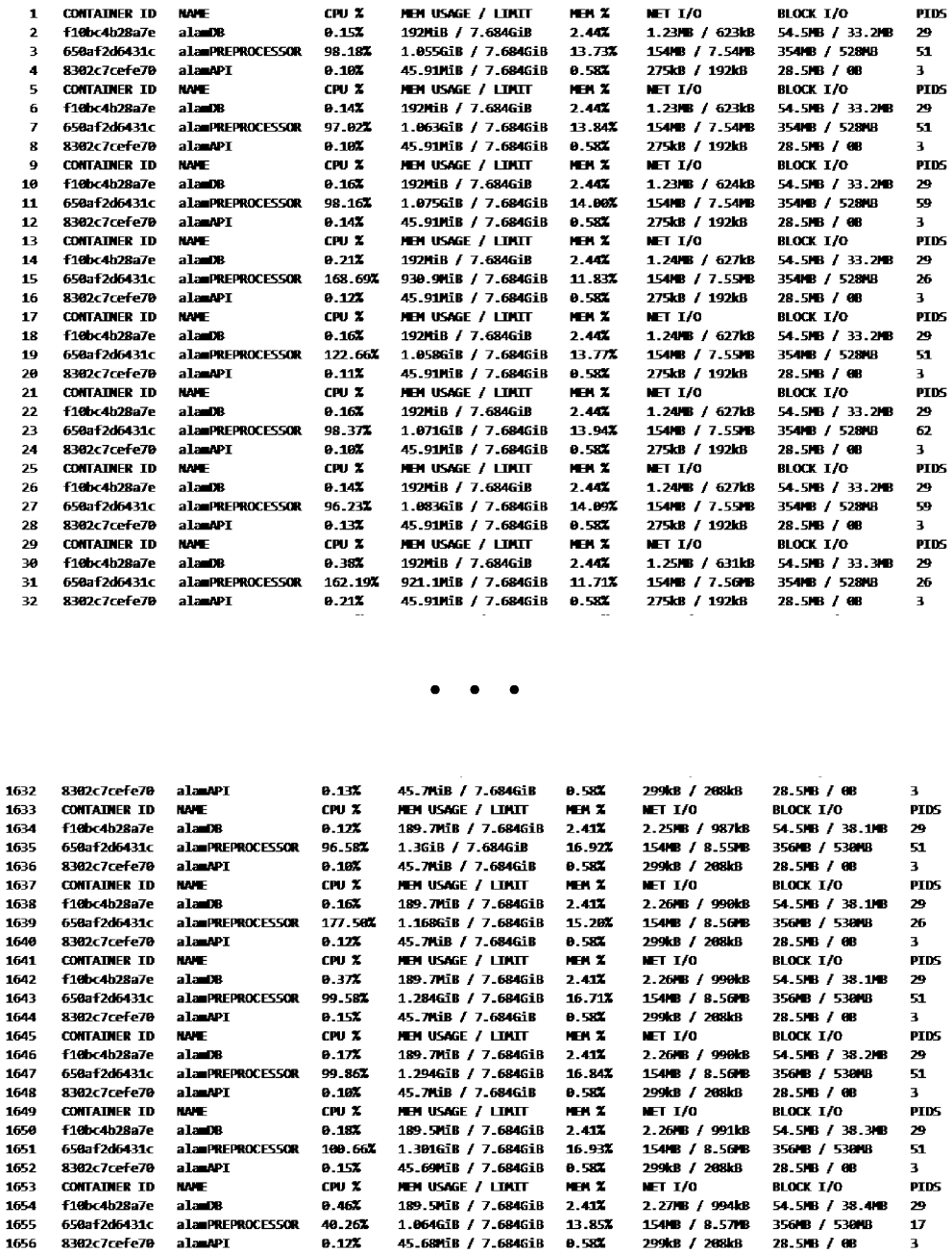

Figure B.57: Raw Logs of Data Processor Module (DPM) System Statistics

```
1   CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
2   f10bc4b28a7e   alamDB              0.22%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
3   650af2d6431c   alamPREPROCESSOR    2.60%     1.303GiB / 7.684GiB   16.96%    156MB / 8.65MB  356MB / 536MB     53
4   8302c7cefe70   alamAPI             0.17%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
5   CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
6   f10bc4b28a7e   alamDB              0.22%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
7   650af2d6431c   alamPREPROCESSOR    3.44%     1.303GiB / 7.684GiB   16.96%    156MB / 8.65MB  356MB / 536MB     53
8   8302c7cefe70   alamAPI             0.18%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
9   CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
10  f10bc4b28a7e   alamDB              0.30%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
11  650af2d6431c   alamPREPROCESSOR    2.87%     1.303GiB / 7.684GiB   16.95%    156MB / 8.66MB  356MB / 537MB     53
12  8302c7cefe70   alamAPI             0.21%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
13  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
14  f10bc4b28a7e   alamDB              0.20%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
15  650af2d6431c   alamPREPROCESSOR    1.33%     1.303GiB / 7.684GiB   16.95%    156MB / 8.66MB  356MB / 537MB     53
16  8302c7cefe70   alamAPI             0.18%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
17  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
18  f10bc4b28a7e   alamDB              0.30%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
19  650af2d6431c   alamPREPROCESSOR    2.47%     1.302GiB / 7.684GiB   16.94%    156MB / 8.67MB  356MB / 537MB     53
20  8302c7cefe70   alamAPI             0.19%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
21  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
22  f10bc4b28a7e   alamDB              0.21%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
23  650af2d6431c   alamPREPROCESSOR    1.58%     1.302GiB / 7.684GiB   16.94%    156MB / 8.67MB  356MB / 538MB     53
24  8302c7cefe70   alamAPI             0.13%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
25  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
26  f10bc4b28a7e   alamDB              0.51%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
27  650af2d6431c   alamPREPROCESSOR    1.88%     1.3GiB / 7.684GiB     16.92%    156MB / 8.67MB  356MB / 538MB     53
28  8302c7cefe70   alamAPI             0.26%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
29  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
30  f10bc4b28a7e   alamDB              0.45%     189.4MiB / 7.684GiB   2.41%     2.3MB / 1.03MB  54.5MB / 40.6MB   31
31  650af2d6431c   alamPREPROCESSOR    4.15%     1.3GiB / 7.684GiB     16.92%    157MB / 8.68MB  356MB / 538MB     53
32  8302c7cefe70   alamAPI             0.22%     45.67MiB / 7.684GiB   0.58%     322kB / 224kB   28.5MB / 0B       3
33  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
```

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8139  650af2d6431c   alamPREPROCESSOR    2.46%     1.135GiB / 7.684GiB   14.77%    308MB / 15.2MB  359MB / 1.06GB    53
8140  8302c7cefe70   alamAPI             0.26%     45.51MiB / 7.684GiB   0.58%     442kB / 305kB   28.5MB / 0B       3
8141  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8142  f10bc4b28a7e   alamDB              0.30%     186.9MiB / 7.684GiB   2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8143  650af2d6431c   alamPREPROCESSOR    0.20%     1.135GiB / 7.684GiB   14.77%    308MB / 15.2MB  359MB / 1.06GB    53
8144  8302c7cefe70   alamAPI             0.27%     45.51MiB / 7.684GiB   0.58%     442kB / 305kB   28.5MB / 0B       3
8145  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8146  f10bc4b28a7e   alamDB              0.55%     186.9MiB / 7.684GiB   2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8147  650af2d6431c   alamPREPROCESSOR    0.50%     1.135GiB / 7.684GiB   14.77%    309MB / 15.2MB  359MB / 1.06GB    53
8148  8302c7cefe70   alamAPI             0.15%     45.51MiB / 7.684GiB   0.58%     442kB / 305kB   28.5MB / 0B       3
8149  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8150  f10bc4b28a7e   alamDB              0.20%     186.9MiB / 7.684GiB   2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8151  650af2d6431c   alamPREPROCESSOR    2.51%     1.135GiB / 7.684GiB   14.77%    309MB / 15.2MB  359MB / 1.06GB    53
8152  8302c7cefe70   alamAPI             0.19%     45.51MiB / 7.684GiB   0.58%     442kB / 305kB   28.5MB / 0B       3
8153  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8154  f10bc4b28a7e   alamDB              0.32%     186.9MiB / 7.684GiB   2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8155  650af2d6431c   alamPREPROCESSOR    2.70%     1.135GiB / 7.684GiB   14.77%    309MB / 15.2MB  359MB / 1.06GB    53
8156  8302c7cefe70   alamAPI             0.16%     45.51MiB / 7.684GiB   0.58%     442kB / 305kB   28.5MB / 0B       3
8157  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8158  f10bc4b28a7e   alamDB              0.31%     186.9MiB / 7.684GiB   2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8159  650af2d6431c   alamPREPROCESSOR    3.63%     1.135GiB / 7.684GiB   14.77%    309MB / 15.2MB  359MB / 1.06GB    53
8160  8302c7cefe70   alamAPI             0.23%     45.51MiB / 7.684GiB   0.58%     443kB / 305kB   28.5MB / 0B       3
8161  CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
8162  f10bc4b28a7e   alamDB              0.72%     187MiB / 7.684GiB     2.38%     2.49MB / 1.27MB  54.5MB / 49.7MB   31
8163  650af2d6431c   alamPREPROCESSOR    4.19%     1.135GiB / 7.684GiB   14.77%    309MB / 15.2MB  359MB / 1.06GB    53
8164  8302c7cefe70   alamAPI             0.21%     45.51MiB / 7.684GiB   0.58%     443kB / 305kB   28.5MB / 0B       3
```

Figure B.58: Raw Logs of alamPREPROCESSOR System Statistics

B.5.2 PSEI Trading Baseline Data

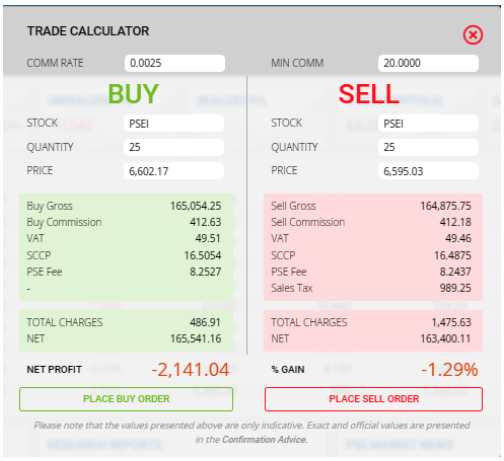


Figure B.59: Day 1 PSEI Trading Raw Data

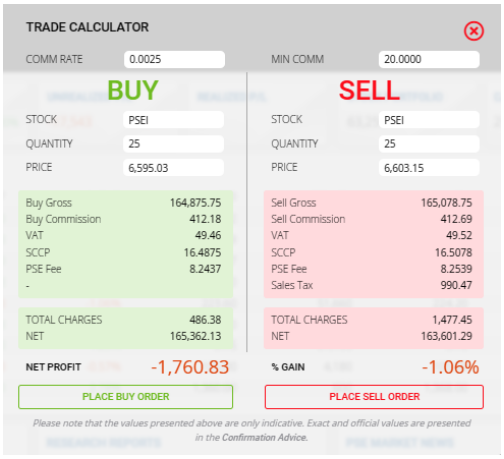


Figure B.60: Day 2 PSEI Trading Raw Data

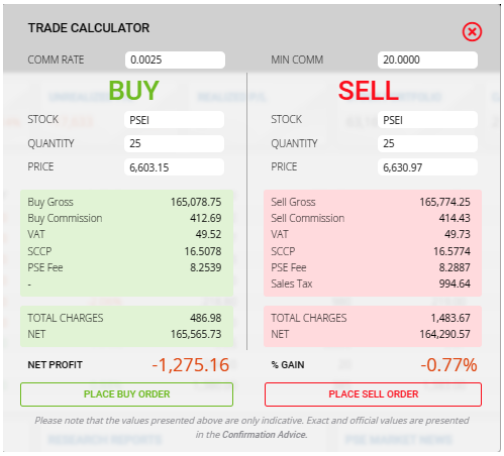


Figure B.61: Day 3 PSEI Trading Raw Data

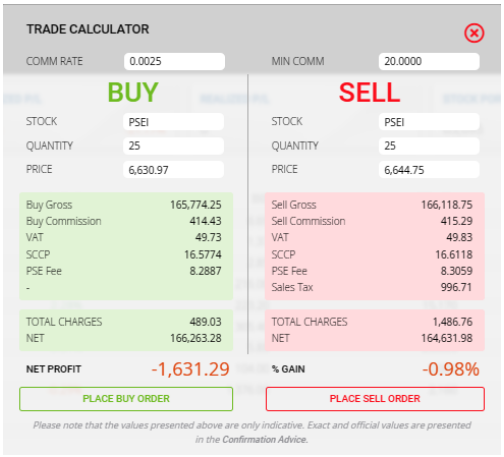


Figure B.62: Day 4 PSEI Trading Raw Data

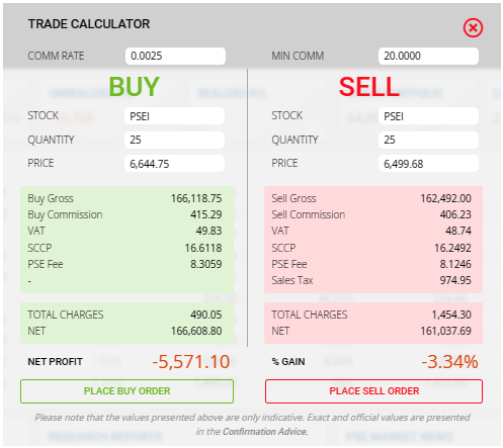


Figure B.63: Day 5 PSEI Trading Raw Data

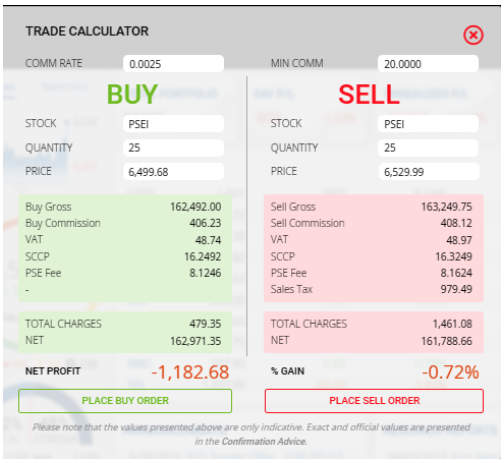


Figure B.64: Day 6 PSEI Trading Raw Data

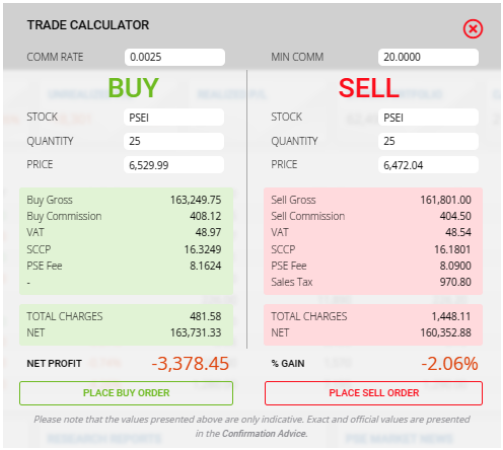


Figure B.65: Day 7 PSEI Trading Raw Data

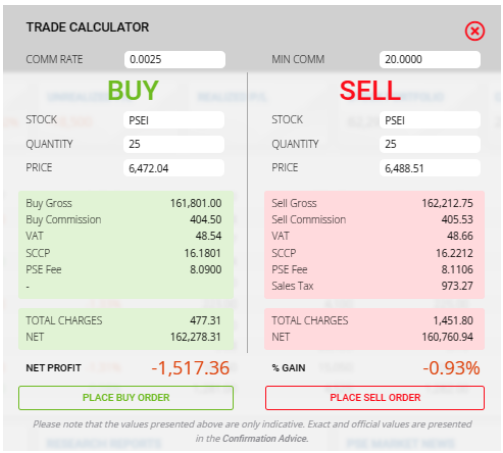


Figure B.66: Day 8 PSEI Trading Raw Data

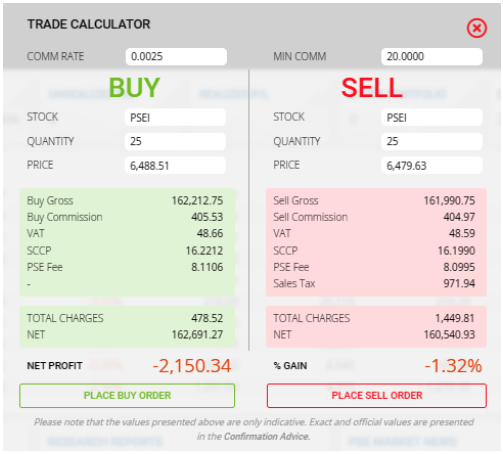


Figure B.67: Day 9 PSEI Trading Raw Data

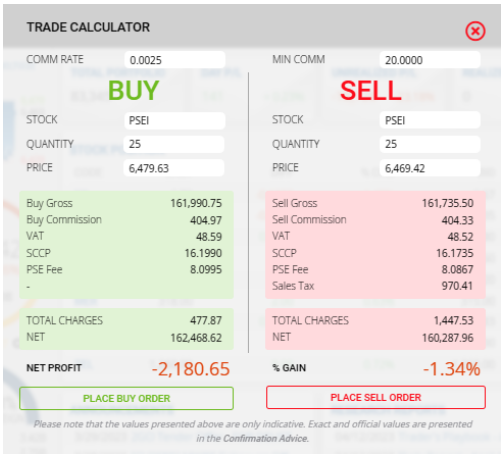
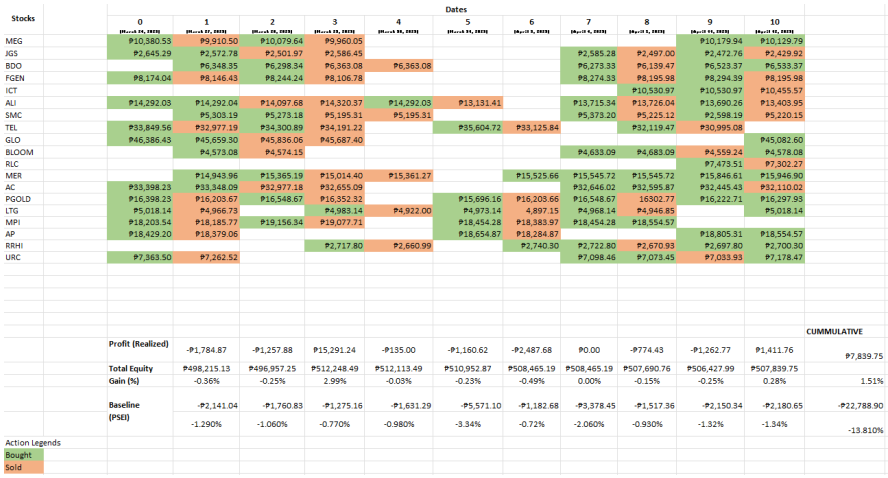


Figure B.68: Day 10 PSEI Trading Raw Data

B.5.3 Raw Real-world alamSYS Application



Stocks		Dates											
		0	1	2	3	4	5	6	7	8	9	10	
MEG		₱10,380.53	₱9,910.50	₱10,079.64	₱9,960.05						₱10,179.94	₱10,129.79	
JGS		₱2,645.29	₱2,572.78	₱2,501.97	₱2,586.45				₱2,585.28	₱2,497.00	₱2,472.76	₱2,429.92	
BDO			₱6,348.35	₱6,298.34	₱6,363.08	₱6,363.08			₱6,273.33	₱6,139.47	₱6,523.37	₱6,533.37	
FGEN		₱8,174.04	₱8,146.43	₱8,244.24	₱8,106.78				₱8,274.33	₱8,195.98	₱8,294.39	₱8,195.98	
ICT										₱10,530.97	₱10,530.97	₱10,455.57	
ALI		₱14,292.03	₱14,292.04	₱14,097.68	₱14,320.37	₱14,292.03	₱13,131.41		₱13,715.34	₱13,726.04	₱13,690.26	₱13,403.95	
SMC			₱5,303.19	₱5,273.18	₱5,195.31	₱5,195.31			₱5,373.20	₱5,225.12	₱2,598.19	₱5,220.15	
TEL		₱33,849.56	₱32,977.19	₱34,300.89	₱34,191.22		₱35,604.72	₱33,125.84		₱32,119.47	₱30,995.08		
GLO		₱46,386.43	₱45,659.30	₱45,836.06	₱45,687.40							₱45,082.60	
BLOOM			₱4,573.08	₱4,574.15					₱4,633.09	₱4,683.09	₱4,559.24	₱4,578.08	
RLC											₱7,473.51	₱7,302.27	
MER			₱14,943.96	₱15,365.19	₱15,014.40	₱15,361.27		₱15,525.66	₱15,545.72	₱15,545.72	₱15,846.61	₱15,946.90	
AC		₱33,398.23	₱33,348.09	₱32,977.18	₱32,655.09				₱32,646.02	₱32,595.87	₱32,445.43	₱32,110.02	
PGOLD		₱16,398.23	₱16,203.67	₱16,548.67	₱16,352.32		₱15,696.16	₱16,203.66	₱16,548.67	16302.77	₱16,222.71	₱16,297.93	
LTG		₱5,018.14	₱4,966.73		₱4,983.14	₱4,922.00	₱4,973.14	4,897.15	₱4,968.14	₱4,946.85		₱5,018.14	
MPI		₱18,203.54	₱18,185.77	₱19,156.34	₱19,077.71		₱18,454.28	₱18,383.97	₱18,454.28	₱18,554.57			
AP		₱18,429.20	₱18,379.06				₱18,654.87	₱18,284.87			₱18,805.31	₱18,554.57	
RRHI					₱2,717.80	₱2,660.99		₱2,740.30	₱2,722.80	₱2,670.93	₱2,697.80	₱2,700.30	
URC		₱7,363.50	₱7,262.52						₱7,098.46	₱7,073.45	₱7,033.93	₱7,178.47	
													CUMMULATIVE
	Profit (Realized)		-₱1,784.87	-₱1,257.88	₱15,291.24	-₱135.00	-₱1,160.62	-₱2,487.68	₱0.00	-₱774.43	-₱1,262.77	₱1,411.76	₱7,839.75
	Total Equity		₱498,215.13	₱496,957.25	₱512,248.49	₱512,113.49	₱510,952.87	₱508,465.19	₱508,465.19	₱507,690.76	₱506,427.99	₱507,839.75	
	Gain (%)		-0.36%	-0.25%	2.99%	-0.03%	-0.23%	-0.49%	0.00%	-0.15%	-0.25%	0.28%	1.51%
	Baseline (PSEI)		-₱2,141.04	-₱1,760.83	-₱1,275.16	-₱1,631.29	-₱5,571.10	-₱1,182.68	-₱3,378.45	-₱1,517.36	-₱2,150.34	-₱2,180.65	-₱22,788.90
			-1.290%	-1.060%	-0.770%	-0.980%	-3.34%	-0.72%	-2.060%	-0.930%	-1.32%	-1.34%	-13.810%
Action Legends													
Bought													
Sold													

Figure B.69: Real World Application Raw Data Logs

Appendix C

Project Management Documentation

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Appendix D

Glossary of Terms

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Appendix E

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Appendix F

Author's Contact Information

The author is open for collaborations and additional conversation in regards to the topics discussed in the development of this Special Problem. Where, the following contact information is given to make it easier for anyone to communicate with the author in the future.


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If you have any questions about this Special Problem or would like to collaborate on it, please feel free to contact the author using any of the above contact details. The author is eager to discuss ideas for more in-depth study and advancement in this area with interested parties.