

Importing Data for Stocks

Set up the Import Options and import the data for daily data

```
opts = spreadsheetImportOptions("NumVariables", 89);

% Specify sheet and range
opts.Sheet = "stocks daily";
opts.DataRange = "A4:CK2222";

% Specify column names and types
opts.VariableNames = ["Date", "LEONARDO", "ECOSUNTEK", "LANDIRENZO", "PIRELLIC",
"STELLANTIS", "PININFARINA", "FRENIBREMBO", "INTESASANPAOLO", "ILLIMITYBANK",
"UNICREDIT", "BANCAGENERALI", "BPERBANCA", "FINECOBANKSPA", "DAVIDECAMPARIMILANO",
"AQUAFIL", "CALTAGIRONE", "ASTALDIDEADDELIST020821", "ENEL", "ALERIONCLEANPOWER",
"A2A", "TERNARETEELETTRICANAZ", "ACEA", "DEACAPITALDEADDELIST080323",
"BANCAMEDIOLANUM", "BANCAINTERMOBILIAREDEADDELIST290422", "TAMBURIINVPARTNERS",
"MEDIOBANCABCFIN", "EQUITAGROUP", "ANIMAHOLDING", "TELECOMITALIARSP",
"TELECOMITALIA", "ENERVIT", "VALSOIA", "CENTRALEDELLATTEDITALIA", "HERA", "IREN",
"ITALGAS", "ELEN", "AMPLIFON", "DELONGHI", "BORGSESIARSPDEADDELIST280721",
"CNHINDUSTRIAL", "FIDIA", "INTERPUMPGROUP", "INTEKGROUP", "ENAV",
"POSTEITALIANE", "CATTOLICAASSICURAZIONIDEADDELIST120822", "RIZZOLICRERDLSMGP",
"CAIROCOMMUNICATION", "MONRIF", "GAMBEROROSSO", "UNIPOLGRUPPOFINANZIARIO",
"ASSICURAZIONIGENERALI", "SNAM", "ENI", "TODS", "RECORDATIINDUACHIMICA",
"RISANAMENTO", "BRIOSCHISVILUPPOIMMBL", "BEEWIZE", "EXPRIVIA", "AUTOGRILL",
"JUVENTUSFOOTBALLCLUB", "SSLAZIO", "CLASSEEDITORI", "BASTOGI", "CEMENTIRHOLDING",
"UNIPOLSAI", "BUZZI", "CREDITOEMILIANO", "DANIELI", "ITALMOBILIARE",
"VINCENZOZUCCHI", "WEBUILD", "VIANINIINDR", "EDISONRSP", "RATTI",
"GABETTIPROPERTYSLTN", "MFEB", "ERG", "CEMBRE", "SABA", "BEGHELLI", "SOL",
"DATALOGIC", "BIESSE", "SAFILOGROUP"];

opts.VariableTypes = ["datetime", "double", "double", "double", "double", "double",
"double", "double", "double", "double", "double", "double", "double", "double"];
% Import the data
import_daily = readtable("C:\Users\Diego\MATLAB Drive\Exam 2023\Dati per
l'esame\data for exam 2023.xlsx", opts, "UseExcel", false)
```

import_daily = 2219x89 table

...

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
1	01-Jan-2015	7.7350	13.6000	0.9168	NaN
2	02-Jan-2015	7.7300	13.6000	0.9186	NaN
3	05-Jan-2015	7.4300	13.6000	0.9219	NaN
4	06-Jan-2015	7.3500	13.6000	0.9122	NaN
5	07-Jan-2015	7.4650	13.6000	0.9191	NaN
6	08-Jan-2015	7.8450	13.6000	0.9344	NaN
7	09-Jan-2015	7.6500	13.6000	0.9214	NaN
8	12-Jan-2015	7.7850	13.6000	0.9335	NaN
9	13-Jan-2015	7.8950	13.6000	0.9585	NaN
10	14-Jan-2015	7.8900	13.6000	0.9770	NaN
11	15-Jan-2015	8.1700	13.3000	0.9946	NaN
12	16-Jan-2015	8.5000	13.5400	0.9899	NaN
13	19-Jan-2015	8.5050	13.5400	1.0057	NaN
14	20-Jan-2015	8.5800	13.5400	1.0001	NaN
15	21-Jan-2015	8.6950	13.5400	0.9807	NaN
16	22-Jan-2015	8.9400	13.5400	0.9899	NaN
17	23-Jan-2015	9.0700	13.5400	0.9955	NaN
18	26-Jan-2015	9.1700	13.6500	0.9909	NaN
19	27-Jan-2015	9.0250	13.8500	0.9881	NaN
20	28-Jan-2015	9.2400	13.8500	0.9761	NaN
21	29-Jan-2015	9.5800	13.8500	0.9566	NaN
22	30-Jan-2015	9.6900	13.8500	0.9538	NaN
23	02-Feb-2015	9.6550	13.8500	0.9677	NaN
24	03-Feb-2015	9.7700	14.3500	0.9862	NaN
25	04-Feb-2015	9.9050	14.9000	0.9723	NaN
26	05-Feb-2015	10.0700	14.9000	0.9631	NaN
27	06-Feb-2015	10.2200	13.7300	1.0001	NaN
28	09-Feb-2015	9.9800	13.7300	1.0048	NaN
29	10-Feb-2015	10.2700	13.7300	0.9723	NaN
30	11-Feb-2015	10.1800	13.3100	0.9686	NaN
31	12-Feb-2015	10.3600	13.9100	0.9723	NaN
32	13-Feb-2015	10.2100	14.2000	0.9473	NaN
33	16-Feb-2015	10.2200	14.2000	0.9501	NaN

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
34	17-Feb-2015	10.2000	14.2400	0.9575	NaN
35	18-Feb-2015	10.3000	13.9000	0.9316	NaN
36	19-Feb-2015	10.3000	13.9000	0.9353	NaN
37	20-Feb-2015	10.3300	13.6400	0.9436	NaN
38	23-Feb-2015	10.9700	13.2000	0.9260	NaN
39	24-Feb-2015	10.8700	13.2000	0.9288	NaN
40	25-Feb-2015	10.8500	13.9400	0.9372	NaN
41	26-Feb-2015	10.8400	13.9400	0.9501	NaN
42	27-Feb-2015	10.8200	13.8900	0.9501	NaN
43	02-Mar-2015	10.8300	13.8900	0.9483	NaN
44	03-Mar-2015	10.8900	13.3900	0.9362	NaN
45	04-Mar-2015	10.9400	13.8000	0.9353	NaN
46	05-Mar-2015	10.9000	13.8000	0.9335	NaN
47	06-Mar-2015	10.8700	13.8000	0.9205	NaN
48	09-Mar-2015	11	13.3900	0.9149	NaN
49	10-Mar-2015	11.2900	13.2900	0.9126	NaN
50	11-Mar-2015	11.9200	13.8900	0.9075	NaN
51	12-Mar-2015	11.8200	13.8900	0.9214	NaN
52	13-Mar-2015	11.8200	13	0.9057	NaN
53	16-Mar-2015	11.9300	13.5800	0.9353	NaN
54	17-Mar-2015	11.6200	13.5700	0.9307	NaN
55	18-Mar-2015	11.2900	13.3700	0.9177	NaN
56	19-Mar-2015	11.4200	13.3700	0.9103	NaN
57	20-Mar-2015	11.4300	13.8000	0.9075	NaN
58	23-Mar-2015	11.3500	13.2000	0.9098	NaN
59	24-Mar-2015	11.4700	13.9700	0.9168	NaN
60	25-Mar-2015	11.1700	13.9700	0.9168	NaN
61	26-Mar-2015	10.9900	13.9700	0.9112	NaN
62	27-Mar-2015	11.0800	13.5500	0.9075	NaN
63	30-Mar-2015	11.1500	13.9300	0.9154	NaN
64	31-Mar-2015	11.0800	13.6700	0.9219	NaN
65	01-Apr-2015	11.3600	13.6700	1.0557	NaN
66	02-Apr-2015	11.3700	13.6700	1.1085	NaN

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
67	03-Apr-2015	11.3700	13.6700	1.1085	NaN
68	06-Apr-2015	11.3700	13.6700	1.1085	NaN
69	07-Apr-2015	11.5100	13.7500	1.1363	NaN
70	08-Apr-2015	11.4500	13.5800	1.1316	NaN
71	09-Apr-2015	11.7000	13.5800	1.1566	NaN
72	10-Apr-2015	11.8100	13.5800	1.1344	NaN
73	13-Apr-2015	11.8600	13.3000	1.1344	NaN
74	14-Apr-2015	11.6600	13.4900	1.0937	NaN
75	15-Apr-2015	11.7800	13.5200	1.0918	NaN
76	16-Apr-2015	11.6400	13.7500	1.0622	NaN
77	17-Apr-2015	11.3600	12.8000	1.0251	NaN
78	20-Apr-2015	11.3700	12.4300	1.0298	NaN
79	21-Apr-2015	11.4500	12.5500	1.0529	NaN
80	22-Apr-2015	11.4100	13.1000	1.0511	NaN
81	23-Apr-2015	11.0500	12.6900	1.0418	NaN
82	24-Apr-2015	11.7700	12.7600	1.0362	NaN
83	27-Apr-2015	11.9400	12.3100	1.0335	NaN
84	28-Apr-2015	11.6600	12.2700	1.0261	NaN
85	29-Apr-2015	11.2000	12.2000	0.9798	NaN
86	30-Apr-2015	11.4500	11.8000	1.0029	NaN
87	01-May-2015	11.4500	11.8000	1.0029	NaN
88	04-May-2015	11.2100	11.5300	0.9835	NaN
89	05-May-2015	10.8900	11.5300	0.9575	NaN
90	06-May-2015	11.0300	11.0600	0.9427	NaN
91	07-May-2015	11.2000	10.8700	0.9353	NaN
92	08-May-2015	11.3800	10.8000	0.9483	NaN
93	11-May-2015	11.4200	10.7000	0.9492	NaN
94	12-May-2015	11.1400	10.8000	0.9510	NaN
95	13-May-2015	11.1200	10.8000	0.9168	NaN
96	14-May-2015	11.2800	10.3500	0.9177	NaN
97	15-May-2015	11.1300	10.6300	0.9242	NaN
98	18-May-2015	11.1400	10.6300	0.9210	NaN
99	19-May-2015	11.5200	10.6300	0.9335	NaN

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
100	20-May-2015	11.4700	10.6300	0.9344	NaN
	:				

Clear temporary variables

```
clear opts
```

Set up the Import Options and import the data for monthly data

```
opts = spreadsheetImportOptions("NumVariables", 89);

% Specify sheet and range
opts.Sheet = "stocks monthly";
opts.DataRange = "A4:CK106";

% Specify column names and types
opts.VariableNames = ["Date", "LEONARDO", "ECOSUNTEK", "LANDIRENZO", "PIRELLIC",
"STELLANTIS", "PININFARINA", "FRENIBREMBO", "INTESASANPAOLO", "ILLIMITYBANK",
"UNICREDIT", "BANCAGENERALI", "BPERBANCA", "FINECOBANKSPA", "DAVIDECAMPARIMILANO",
"AQUAFIL", "CALTAGIRONE", "ASTALDIDEADDELIST020821", "ENEL", "ALERIONCLEANPOWER",
"A2A", "TERNARETEELETTRICANAZ", "ACEA", "DEACAPITALDEADDELIST080323",
"BANCAMEDIOLANUM", "BANCAINTERMOBILIAREDEADDELIST290422", "TAMBURIINVPARTNERS",
"MEDIOBANCABCFIN", "EQUITAGROUP", "ANIMAHOLDING", "TELECOMITALIARSP",
"TELECOMITALIA", "ENERVIT", "VALSOIA", "CENTRALEDELLATTEDITALIA", "HERA", "IREN",
"ITALGAS", "ELEN", "AMPLIFON", "DELONGHI", "BORGSESIARSPDEADDELIST280721",
"CNHINDUSTRIAL", "FIDIA", "INTERPUMPGROUP", "INTEKGROUP", "ENAV",
"POSTEITALIANE", "CATTOLICAASSICURAZIONIDEADDELIST120822", "RIZZOLICRERDLSMGP",
"CAIROCOMMUNICATION", "MONRIF", "GAMBEROROSSO", "UNIPOLGRUPPOFINANZIARIO",
"ASSICURAZIONIGENERALI", "SNAM", "ENI", "TODS", "RECORDATIINDUACHIMICA",
"RISANAMENTO", "BRIOSCHISVILUPPOIMMBL", "BEEWIZE", "EXPRIVIA", "AUTOGRILL",
"JUVENTUSFOOTBALLCLUB", "SSLAZIO", "CLASSEITORI", "BASTOGI", "CEMENTIRHOLDING",
"UNIPOLSAI", "BUZZI", "CREDITOEMILIANO", "DANIELI", "ITALMOBILIARE",
"VINCENZOZUCCHI", "WEBUILD", "VIANINIINDR", "EDISONRSP", "RATTI",
"GABETTIPROPERTYSLTN", "MFEB", "ERG", "CEMBRE", "SABAF", "BEGHELLI", "SOL",
"DATALOGIC", "BIESSE", "SAFILOGROUP"];
opts.VariableTypes = ["datetime", "double", "double", "double", "double", "double",
"double", "double", "double", "double", "double", "double", "double"];
```

```
% Import the data
import_monthly = readtable("C:\Users\Diego\MATLAB Drive\Exam 2023\Dati per
l'esame\data for exam 2023.xlsx", opts, "UseExcel", false)
```

```
import_monthly = 103x89 table
```

...

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
1	01-Jan-2015	7.7350	13.6000	0.9168	NaN
2	01-Feb-2015	9.6550	13.8500	0.9677	NaN
3	01-Mar-2015	10.8300	13.8900	0.9483	NaN
4	01-Apr-2015	11.3600	13.6700	1.0557	NaN
5	01-May-2015	11.4500	11.8000	1.0029	NaN
6	01-Jun-2015	12.0700	10.6200	0.9182	NaN
7	01-Jul-2015	11.6100	11.4500	0.9297	NaN
8	01-Aug-2015	13.4500	11.5800	0.8371	NaN
9	01-Sep-2015	11.8500	9.4500	0.7094	NaN
10	01-Oct-2015	11.2000	8.9800	0.6945	NaN
11	01-Nov-2015	11.9400	8.3600	0.7214	NaN
12	01-Dec-2015	13.5500	7.0900	0.6927	NaN
13	01-Jan-2016	12.9000	6.9000	0.6894	NaN
14	01-Feb-2016	10.9500	7.5500	0.5871	NaN
15	01-Mar-2016	10.1900	6.5300	0.5232	NaN
16	01-Apr-2016	11.0300	6.1000	0.4732	NaN
17	01-May-2016	10.9900	6.1000	0.4806	NaN
18	01-Jun-2016	10.4400	6	0.4936	NaN
19	01-Jul-2016	9.0350	5.1000	0.3991	NaN
20	01-Aug-2016	9.8300	4.7600	0.4435	NaN
21	01-Sep-2016	10.2400	4.7400	0.4238	NaN
22	01-Oct-2016	9.9700	4.2500	0.3785	NaN
23	01-Nov-2016	11.1200	4.1800	0.3401	NaN
24	01-Dec-2016	12.1900	3.7500	0.3331	NaN
25	01-Jan-2017	13.4100	3.7600	0.3321	NaN
26	01-Feb-2017	12.3300	3.9100	0.4398	NaN
27	01-Mar-2017	13.4200	4.2900	0.4179	NaN
28	01-Apr-2017	13.2700	4.3000	0.4445	NaN
29	01-May-2017	14.4300	4.0700	0.4503	NaN

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
30	01-Jun-2017	15.9400	15.2000	0.5093	NaN
31	01-Jul-2017	14.6900	8.2600	0.7408	NaN
32	01-Aug-2017	14.7600	8.6700	0.9029	NaN
33	01-Sep-2017	14.3000	9.3300	0.8200	NaN
34	01-Oct-2017	15.8800	8.9000	1.7780	NaN
35	01-Nov-2017	15.0200	8.6750	1.4632	6.9900
36	01-Dec-2017	9.9200	7.6300	1.5132	6.9000
37	01-Jan-2018	9.9200	8.0100	1.4539	7.2500
38	01-Feb-2018	9.8300	8	1.4632	7.7640
39	01-Mar-2018	8.8380	7.1200	1.2242	7.0480
40	01-Apr-2018	9.3780	7.1800	1.3983	7.2000
41	01-May-2018	9.6100	6.8000	1.4168	7.2040
42	01-Jun-2018	8.9840	6.2600	1.3502	7.3280
43	01-Jul-2018	8.3680	5.1400	1.2187	7.1520
44	01-Aug-2018	10.3950	6.2600	1.2594	7.3520
45	01-Sep-2018	9.6780	5.3400	1.1464	6.8620
46	01-Oct-2018	10.4400	5.4200	1.1483	7.1920
47	01-Nov-2018	9.5220	4.8500	0.9909	6.4460
48	01-Dec-2018	8.9380	4.3600	1.0779	6.4340
49	01-Jan-2019	7.6780	4.3500	1.0409	5.6100
50	01-Feb-2019	8.5480	4.7000	1.1779	5.6980
51	01-Mar-2019	8.8120	4.9000	1.2465	6.0760
52	01-Apr-2019	10.4150	5.1400	1.1205	5.8280
53	01-May-2019	10.2950	4.7000	1.0890	6.5080
54	01-Jun-2019	10.1750	4.9800	1.0594	5.1120
55	01-Jul-2019	11.2850	5	1.0501	5.3060
56	01-Aug-2019	11.1100	5.0500	0.9427	5.3880
57	01-Sep-2019	11.2800	4.7400	0.8751	4.7100
58	01-Oct-2019	10.6650	5.2000	0.9122	5.4240
59	01-Nov-2019	10.5350	4.7600	0.8686	5.2400
60	01-Dec-2019	10.1600	6.1000	0.9242	5.0980
61	01-Jan-2020	10.4500	6.9000	0.8362	5.1400
62	01-Feb-2020	11.1400	7.4500	0.8334	4.3880

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
63	01-Mar-2020	8.9520	6.1500	0.6853	4.1000
64	01-Apr-2020	5.8580	5.3000	0.4112	3.0580
65	01-May-2020	6.2940	5.7000	0.4112	3.5540
66	01-Jun-2020	5.9120	7.5500	0.5964	4.0220
67	01-Jul-2020	5.8340	8.1500	0.5779	3.6800
68	01-Aug-2020	5.5380	7.3000	0.6112	3.4640
69	01-Sep-2020	5.6340	7.1000	0.5556	3.5750
70	01-Oct-2020	4.8780	7	0.4945	3.5830
71	01-Nov-2020	4.2420	6.2500	0.5297	3.6500
72	01-Dec-2020	6.0860	6.9500	0.7186	4.5010
73	01-Jan-2021	5.9100	7.9000	0.7575	4.4330
74	01-Feb-2021	5.7200	7.9500	0.8816	4.2800
75	01-Mar-2021	6.8900	8.2500	1.0233	4.8400
76	01-Apr-2021	7.0180	7.9000	0.9983	4.9940
77	01-May-2021	6.8760	7.9500	0.9538	4.7330
78	01-Jun-2021	7.1780	8.2000	0.9122	4.9250
79	01-Jul-2021	6.9700	7.9500	0.8770	4.9230
80	01-Aug-2021	6.7880	7.4500	0.8584	5.1400
81	01-Sep-2021	7.0540	7.7000	0.8899	5.1440
82	01-Oct-2021	7.1500	7.9000	0.8483	5.0800
83	01-Nov-2021	6.4340	8.0500	0.8659	5.3260
84	01-Dec-2021	6.1080	11.8000	0.7677	5.5820
85	01-Jan-2022	6.3880	11.3000	0.7770	6.1520
86	01-Feb-2022	6.4400	10.2000	0.7844	6.3220
87	01-Mar-2022	8.1160	10.6000	0.7418	4.6010
88	01-Apr-2022	9.0860	10.3000	0.8121	4.9060
89	01-May-2022	9.6320	10.3000	0.7742	4.6170
90	01-Jun-2022	10.1700	12.1500	0.7557	4.6510
91	01-Jul-2022	9.8620	10.5000	0.6862	3.9370
92	01-Aug-2022	9.2720	11.1500	0.6010	4.1770
93	01-Sep-2022	7.8920	10.4000	0.5490	3.7340
94	01-Oct-2022	7.3880	11.2500	0.4425	3.3660
95	01-Nov-2022	8.1660	10.5000	0.4715	3.7240

	Date	LEONARDO	ECOSUNTEK	LANDIRENZO	PIRELLIC
96	01-Dec-2022	7.6900	10	0.5560	4.3260
97	01-Jan-2023	8.2940	12.8000	0.5610	4.0890
98	01-Feb-2023	9.6000	19.3000	0.5900	4.5840
99	01-Mar-2023	10.6200	19.2000	0.5620	4.8910
100	01-Apr-2023	10.9550	19.2500	0.5680	4.6260
:					

Clear temporary variables

```
clear opts
```

Data handling for stocks

```
names_of_companies = ["LEONARDO", "ECOSUNTEK", "LANDIRENZO", "PIRELLIC",
"STELLANTIS", "PININFARINA", "FRENIBREMBO", "INTESASANPAOLO", "ILLIMITYBANK",
"UNICREDIT", "BANCAGENERALI", "BPERBANCA", "FINECOBANKSPA", "DAVIDECAMPARIMILANO",
"AQUAFIL", "CALTAGIRONE", "ASTALDIDEADDELIST020821", "ENEL", "ALERIONCLEANPOWER",
"A2A", "TERNARETEELETTRICANAZ", "ACEA", "DEACAPITALDEADDELIST080323",
"BANCAMEDIOLANUM", "BANCINTERMOBILIAREDEADDELIST290422", "TAMBURIINVPARTNERS",
"MEDIOBANCABCFIN", "EQUITAGROUP", "ANIMAHOLDING", "TELECOMITALIARSP",
"TELECOMITALIA", "ENERVIT", "VALSOIA", "CENTRALEDELLATTEDITALIA", "HERA", "IREN",
"ITALGAS", "ELEN", "AMPLIFON", "DELONGHI", "BORGSESIARSPDEADDELIST280721",
"CNHINDUSTRIAL", "FIDIA", "INTERPUMPGROUP", "INTEKGROUP", "ENAV",
"POSTEITALIANE", "CATTOLICAASSICURAZIONIDEADDELIST120822", "RIZZOLICRERDLSMGP",
"CAIROCOMMUNICATION", "MONRIF", "GAMBEROROSSO", "UNIPOLGRUPPOFINANZIARIO",
"ASSICURAZIONIGENERALI", "SNAM", "ENI", "TODS", "RECORDATIINDUACHIMICA",
"RISANAMENTO", "BRIOSCHISVILUPPOIMMBL", "BEEWIZE", "EXPRIVIA", "AUTOGRILL",
"JUVENTUSFOOTBALLCLUB", "SSLAZIO", "CLASSEDITORI", "BASTOGI", "CEMENTIRHOLDING",
"UNIPOLSAI", "BUZZI", "CREDITOEMILIANO", "DANIELI", "ITALMOBILIARE",
"VINCENZOZUCCHI", "WEBUILD", "VIANINIINDR", "EDISONRSP", "RATTI",
"GABETTIPROPERTYSLTN", "MFEB", "ERG", "CEMBRE", "SABA", "BEGHELLI", "SOL",
"DATALOGIC", "BIESSE", "SAFILOGROUP"];
```

Daily

```
date_daily = table2array(import_daily(:,1));
prices_daily = table2array(import_daily(:,2:end));

% Calculate returns
returns_daily = tick2ret(prices_daily)
```

```
returns_daily = 2218x88
-0.0006      0    0.0020      NaN    0.0078    0.0184    0.0047    0.0132 ...
-0.0388      0    0.0036      NaN   -0.0217   -0.0200   -0.0101   -0.0595
-0.0108      0   -0.0105      NaN    0.0159   -0.0025   -0.0160   -0.0139
 0.0156      0    0.0076      NaN    0.0088    0.0077   -0.0107   -0.0123
 0.0509      0    0.0166      NaN    0.0273   -0.0133    0.0130    0.0552
```

```

-0.0249      0   -0.0139      NaN  -0.0045  -0.0186  -0.0110  -0.0405
 0.0176      0   0.0131      NaN   0.0252  0.0124  -0.0082  0.0220
 0.0141      0   0.0268      NaN   0.0187  0.0226  0.0323  0.0301
-0.0006      0   0.0193      NaN  -0.0183  -0.0031  0.0164  -0.0017
 0.0355  -0.0221  0.0180      NaN   0.0089  -0.0152  0.0172  0.0293
  :

```

Monthly

```

date_monthly = table2array(import_monthly(:,1));
prices_monthly = table2array(import_monthly(:,2:end));

% Calculate returns
returns_monthly = tick2ret(prices_monthly)

```

```

returns_monthly = 102x88
 0.2482  0.0184  0.0555      NaN  0.2229  0.1752  0.1289  0.0586 ...
 0.1217  0.0029  -0.0200     NaN  0.2010  0.1167  0.0937  0.1490
 0.0489  -0.0158  0.1133     NaN  0.0724  0.3812  0.1076  0.0869
 0.0079  -0.1368  -0.0500    NaN  -0.1171 -0.1217  -0.0576  -0.0581
 0.0541  -0.1000  -0.0845    NaN  0.0966 -0.0409  0.0832  0.0875
-0.0381  0.0782  0.0125     NaN  -0.0949 -0.0499  0.0039  0.0195
 0.1585  0.0114  -0.0996    NaN  0.1200  0.0017  0.0806  0.0556
-0.1190  -0.1839  -0.1526    NaN  -0.1819 -0.1053  -0.1347  -0.1054
-0.0549  -0.0497  -0.0210    NaN  -0.0222  0.0986  -0.0289  -0.0120
 0.0661  -0.0690  0.0387     NaN  0.1289  0.1167  0.1637  0.0192
  :

```

1. Descriptive statistics for stocks

Daily

```

mean_daily = mean(returns_daily,"omitmissing"); % Mean of returns
var_daily = var(returns_daily,"omitmissing"); % Variance of returns
std_daily = std(returns_daily,"omitmissing"); % Standard deviation of returns
skewness_daily = skewness(returns_daily); % Skewness of returns
kurtosis_daily = kurtosis(returns_daily); % Kurtosis of returns
h_d = [];
for i=1:88
h = jbtest(returns_daily(:,i));
h_d = [h_d ; h];
end
h_d; % where 1's are rejecting H0 of normality distribution
find(h_d == 0) % all the securities reject H0

```

ans =

0x1 empty double column vector

```

% Table
summary_statistics_daily =
table(mean_daily',var_daily',std_daily',skewness_daily',kurtosis_daily','VariableNam

```

```
es', {'Mean', 'Variance', 'Standard Deviation', 'Skewness',
'Kurtosis'}, 'RowNames', names_of_companies)
```

```
summary_statistics_daily = 88x5 table
```

	Mean	Variance	Standard Deviation	Skewness
1 LEONARDO	0.0004	0.0005	0.0234	-0.3340
2 ECOSUNTEK	0.0007	0.0010	0.0319	2.5417
3 LANDIRENZO	0.0002	0.0009	0.0307	1.0364
4 PIRELLIC	-0	0.0005	0.0223	-0.0416
5 STELLANTIS	0.0008	0.0006	0.0244	-0.4510
6 PININFARINA	0.0003	0.0013	0.0354	-0.5498
7 FRENIBREMBO	0.0006	0.0004	0.0194	0.1285
8 INTESASANPAOLO	0.0002	0.0004	0.0212	-0.7622
9 ILLIMITYBANK	0.0001	0.0004	0.0193	0.0423
10 UNICREDIT	0.0003	0.0007	0.0273	-0.0340
11 BANCAGENERALI	0.0003	0.0004	0.0195	0.0236
12 BPERBANCA	0.0003	0.0008	0.0288	0.1673
13 FINECOBANKSPA	0.0006	0.0004	0.0205	-0.1231
14 DAVIDECAMPARIMILANO	0.0008	0.0003	0.0160	-0.2503
15 AQUAFIL	-0.0003	0.0006	0.0243	0.3627
16 CALTAGIRONE	0.0005	0.0003	0.0174	0.1289
17 ASTALDIDEADDELIST020821	-0.0004	0.0013	0.0363	0.2984
18 ENEL	0.0004	0.0002	0.0158	-1.1218
19 ALERIONCLEANPOWER	0.0014	0.0006	0.0254	1.6665
20 A2A	0.0005	0.0003	0.0164	-0.8775
21 TERNARETEELETTRICANAZ	0.0004	0.0002	0.0139	-0.6506
22 ACEA	0.0003	0.0003	0.0158	-0.2565
23 DEACAPITALDEADDELIST080323	0.0001	0.0003	0.0164	1.7254
24 BANCAMEDOLANUM	0.0004	0.0004	0.0198	-0.4357
25 BANCAINTERMOBILIAREDEADDELIS...	-0.0005	0.0021	0.0460	1.1564
26 TAMBURIINVPARTNERS	0.0007	0.0003	0.0162	0.2296
27 MEDIOBANCABCFIN	0.0004	0.0004	0.0209	-0.8595
28 EQUITAGROUP	0.0003	0.0003	0.0161	0.9083
29 ANIMAHOLDING	0.0002	0.0006	0.0239	0.1156
30 TELECOMITALIARSP	-0.0002	0.0006	0.0240	0.1366

	Mean	Variance	Standard Deviation	Skewness
31 TELECOMITALIA	-0.0003	0.0006	0.0243	0.5488
32 ENERVIT	0.0001	0.0003	0.0185	0.8285
33 VALSOIA	-0.0001	0.0003	0.0176	0.6918
34 CENTRALEDELLATTEDITALIA	0.0002	0.0004	0.0194	2.7837
35 HERA	0.0003	0.0002	0.0157	-0.5135
36 IREN	0.0004	0.0003	0.0163	-0.5130
37 ITALGAS	0.0003	0.0002	0.0152	-0.5294
38 ELEN	0.0011	0.0006	0.0237	0.2658
39 AMPLIFON	0.0011	0.0004	0.0201	-0.3926
40 DELONGHI	0.0003	0.0004	0.0208	0.2056
41 BORGOSEIARSPDEADDELIST280721	0.0007	0.0007	0.0265	5.0945
42 CNHINDUSTRIAL	0.0006	0.0005	0.0225	-0.3874
43 FIDIA	0.0001	0.0010	0.0317	2.6581
44 INTERPUMPGROUP	0.0008	0.0004	0.0193	-0.1230
45 INTEKGROUP	0.0008	0.0005	0.0221	1.0721
46 ENAV	0.0002	0.0002	0.0154	1.1436
47 POSTEITALIANE	0.0004	0.0003	0.0177	-1.2545
48 CATTOLICAASSICURAZIONIDEADDE...	0.0003	0.0004	0.0205	3.3246
49 RIZZOLICRERDLSMGP	0.0002	0.0006	0.0254	1.0581
50 CAIROCOMMUNICATION	-0.0003	0.0004	0.0209	0.4600
51 MONRIF	-0.0004	0.0006	0.0253	2.3450
52 GAMBEROROSSO	0	0.0011	0.0330	3.0587
53 UNIPOLGRUPPOFINANZIARIO	0.0003	0.0005	0.0213	-0.2800
54 ASSICURAZIONIGENERALI	0.0002	0.0002	0.0157	-0.7367
55 SNAME	0.0003	0.0002	0.0147	-1.1888
56 ENI	0.0001	0.0003	0.0181	-0.9681
57 TODS	0	0.0005	0.0227	0.8242
58 RECORDATIINDUACHIMICA	0.0007	0.0003	0.0173	0.0452
59 RISANAMENTO	0.0006	0.0012	0.0342	1.4250
60 BRIOSCHISVILUPPOIMMBL	0.0002	0.0005	0.0234	0.5595
61 BEEWIZE	0.0001	0.0011	0.0328	2.3047
62 EXPRIVIA	0.0008	0.0009	0.0297	1.8577
63 AUTOGRILL	0.0003	0.0005	0.0227	1.3272

	Mean	Variance	Standard Deviation	Skewness
64 JUVENTUSFOOTBALLCLUB	0.0007	0.0007	0.0263	0.2572
65 SSLAZIO	0.0007	0.0006	0.0249	0.2767
66 CLASSEDEDITORI	-0.0007	0.0009	0.0303	1.5275
67 BASTOGI	-0.0003	0.0005	0.0231	1.1383
68 CEMENTIRHOLDING	0.0004	0.0004	0.0208	0.1775
69 UNIPOLSAI	0.0001	0.0003	0.0158	-0.1723
70 BUZZI	0.0005	0.0004	0.0198	-0.0347
71 CREDITOEMILIANO	0.0002	0.0003	0.0183	-0.0358
72 DANIELI	0.0002	0.0004	0.0207	0.5873
73 ITALMOBILIARE	0.0006	0.0003	0.0173	2.2125
74 VINCENZOZUCCHI	0.0003	0.0013	0.0361	2.9362
75 WEBUILD	0.0001	0.0006	0.0246	-0.1917
76 VIANINIINDR	0.0002	0.0003	0.0180	0.3824
77 EDISONRSP	0.0003	0.0002	0.0143	-0.3541
78 RATTI	0.0003	0.0004	0.0202	0.9430
79 GABETTIPROPERTYSLTN	0.0004	0.0008	0.0284	1.2277
80 MFEB	-0.0002	0.0006	0.0239	1.1638
81 ERG	0.0006	0.0003	0.0173	-0.1495
82 CEMBRE	0.0006	0.0003	0.0179	0.1494
83 SABAFA	0.0003	0.0003	0.0186	0.4414
84 BEGHELLI	0.0001	0.0005	0.0234	1.9735
85 SOL	0.0008	0.0003	0.0176	0.3806
86 DATALOGIC	0.0002	0.0006	0.0242	0.4233
87 BIESSE	0.0005	0.0007	0.0274	-0.1509
88 SAFILOGROUP	-0.0003	0.0008	0.0287	0.4320

Monthly

```

mean_monthly = mean(returns_monthly, "omitmissing"); % Mean of returns
var_monthly = var(returns_monthly, "omitmissing"); % Variance of returns
std_monthly = std(returns_monthly, "omitmissing"); % Standard deviation of returns
skewness_monthly = skewness(returns_monthly); % Skewness of returns
kurtosis_monthly = kurtosis(returns_monthly); % Kurtosis of returns
h_m = [];
p_val = [];
for i = 1:88
    [h2,p] = jbtest(returns_monthly(:,i));
    h_m = [h_m ; h2];

```

```

p_val = [p_val ; p];
end

```

Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is greater than the largest tabulated value, returning 0.5.
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 Warning: P is less than the smallest tabulated value, returning 0.001.
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 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is less than the smallest tabulated value, returning 0.001.
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 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.
 Warning: P is less than the smallest tabulated value, returning 0.001.
 Warning: P is greater than the largest tabulated value, returning 0.5.

```

h_m; % where 1's are rejecting H0 of normality distribution
f = find(h_m == 0); % 30 securities doesn't reject H0
% which ones
table(p_val(f), 'RowNames', names_of_companies(f))

```

ans = 30x1 table

	Var1
1 PIRELLIC	0.0891
2 STELLANTIS	0.1073
3 FRENIBREMBO	0.5000
4 BPERBANCA	0.1217
5 FINECOBANKSPA	0.5000

	Var1
6 DAVIDECAMPARIMILANO	0.1323
7 AQUAFIL	0.0696
8 CALTAGIRONE	0.1663
9 ENEL	0.2381
10 TERNARETEELETTRICANAZ	0.4542
11 ACEA	0.4235
12 TAMBURIINVPARTNERS	0.5000
13 ANIMA HOLDING	0.1621
14 ENERVIT	0.1446
15 ITALGAS	0.5000
16 ELEN	0.5000
17 DELONGHI	0.5000
18 INTERPUMPGROUP	0.0588
19 POSTEITALIANE	0.0728
20 CAIROCOMMUNICATION	0.1576
21 SNAM	0.3356
22 RECORDATIINDUACHIMICA	0.1950
23 BRIOSCHISVILUPPOIMMBL	0.0513
24 UNIPOLSAI	0.2214
25 BUZZI	0.5000
26 DANIELI	0.2886
27 SABAF	0.5000
28 SOL	0.1959
29 DATALOGIC	0.3954
30 BIESSE	0.5000

% Table

```
summary_statistics_monthly =
table(mean_monthly',var_monthly',std_monthly',skewness_monthly',kurtosis_monthly','VariableNames',
{'Mean','Variance','Standard Deviation','Skewness',
'Kurtosis'},'RowNames', names_of_companies)
```

```
summary_statistics_monthly = 88x5 table
```

	Mean	Variance	Standard Deviation	Skewness
1 LEONARDO	0.0091	0.0123	0.1109	0.1964

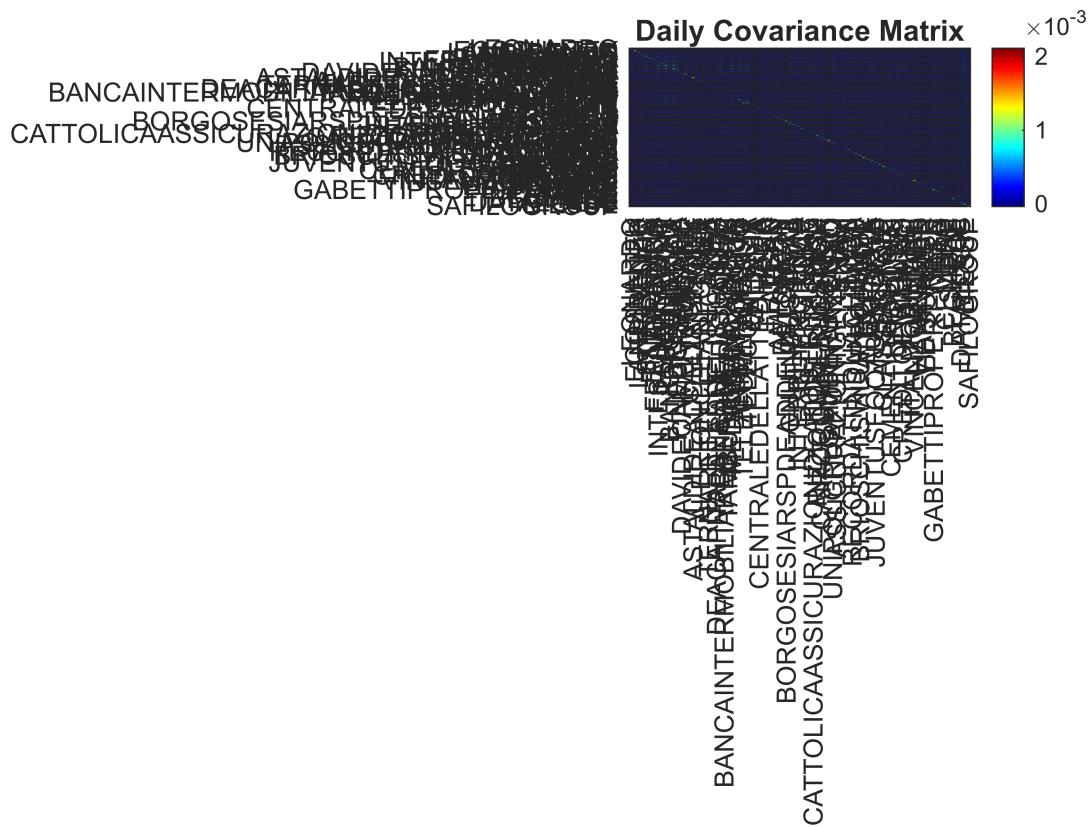
	Mean	Variance	Standard Deviation	Skewness
2 ECOSUNTEK	0.0254	0.0892	0.2987	7.4527
3 LANDIRENZO	0.0061	0.0287	0.1695	3.5205
4 PIRELLIC	-0.0016	0.0090	0.0946	-0.4212
5 STELLANTIS	0.0190	0.0144	0.1200	-0.2058
6 PININFARINA	-0.0024	0.0143	0.1197	1.0852
7 FRENIBREMBO	0.0133	0.0091	0.0952	-0.0127
8 INTESASANPAOLO	0.0048	0.0092	0.0961	-0.3923
9 ILLIMITYBANK	-0.0018	0.0089	0.0945	-0.9665
10 UNICREDIT	0.0061	0.0147	0.1213	-0.2012
11 BANCAGENERALI	0.0075	0.0082	0.0907	-0.6400
12 BPERBANCA	0.0054	0.0165	0.1285	0.3944
13 FINECOBANKSPA	0.0133	0.0076	0.0873	-0.0795
14 DAVIDECAMPARIMILANO	0.0179	0.0047	0.0683	-0.3676
15 AQUAFIL	-0.0085	0.0098	0.0990	0.0563
16 CALTAGIRONE	0.0099	0.0056	0.0750	-0.1507
17 ASTALDIDEADDELIST020821	-0.0099	0.0221	0.1488	-0.4118
18 ENEL	0.0072	0.0041	0.0639	-0.0580
19 ALERIONCLEANPOWER	0.0298	0.0160	0.1266	1.8385
20 A2A	0.0097	0.0052	0.0724	-0.9364
21 TERNARETEELETTRICANAZ	0.0083	0.0023	0.0478	-0.0908
22 ACEA	0.0059	0.0059	0.0767	-0.2818
23 DEACAPITALDEADDELIST080323	0.0029	0.0069	0.0828	0.7593
24 BANCAMEDIOLANUM	0.0086	0.0081	0.0899	-0.4491
25 BANCAINTERMOBILIAREDEADDELIS...	-0.0199	0.0274	0.1656	0.8572
26 TAMBURIINVPARTNERS	0.0144	0.0042	0.0650	-0.1023
27 MEDIOBANCABCFIN	0.0094	0.0087	0.0933	-0.6996
28 EQUITAGROUP	0.0051	0.0045	0.0667	0.0475
29 ANIMA HOLDING	0.0046	0.0121	0.1101	0.0682
30 TELECOMITALIARSP	-0.0048	0.0105	0.1025	0.6893
31 TELECOMITALIA	-0.0064	0.0117	0.1080	1.2099
32 ENERVIT	0.0013	0.0039	0.0627	0.0382
33 VALSOIA	-0.0017	0.0059	0.0766	0.9690
34 CENTRALEDELLATTEDITALIA	0.0025	0.0050	0.0707	1.8993

	Mean	Variance	Standard Deviation	Skewness
35 HERA	0.0055	0.0042	0.0647	-0.5662
36 IREN	0.0093	0.0059	0.0769	-0.5016
37 ITALGAS	0.0080	0.0037	0.0608	-0.2018
38 ELEN	0.0272	0.0174	0.1321	0.1709
39 AMPLIFON	0.0224	0.0072	0.0850	-0.6834
40 DELONGHI	0.0071	0.0088	0.0939	-0.0684
41 BORGOSESIARSPDEADDELIST280721	0.0180	0.0285	0.1688	4.1847
42 CNHINDUSTRIAL	0.0129	0.0095	0.0975	-0.2017
43 FIDIA	0.0059	0.0406	0.2014	4.9587
44 INTERPUMPGROUP	0.0187	0.0086	0.0928	-0.5394
45 INTEKGROUP	0.0160	0.0097	0.0987	0.9259
46 ENAV	0.0030	0.0044	0.0661	-0.1671
47 POSTEITALIANE	0.0068	0.0048	0.0694	-0.3165
48 CATTOLICAASSICURAZIONIDEADDE...	0.0077	0.0128	0.1131	0.9986
49 RIZZOLICRERDLSMGP	0.0044	0.0146	0.1209	1.0369
50 CAIROCOMMUNICATION	-0.0057	0.0096	0.0982	0.3421
51 MONRIF	-0.0114	0.0089	0.0942	1.8109
52 GAMBEROROSSO	0.0040	0.0493	0.2220	5.4006
53 UNIPOLGRUPPOFINANZIARIO	0.0066	0.0094	0.0967	-0.5165
54 ASSICURAZIONIGENERALI	0.0039	0.0054	0.0732	-0.1959
55 SNAME	0.0048	0.0027	0.0519	-0.2126
56 ENI	0.0020	0.0058	0.0760	0.6288
57 TODS	-0.0003	0.0122	0.1104	1.0702
58 RECORDATIINDUACHIMICA	0.0144	0.0048	0.0696	0.0478
59 RISANAMENTO	0.0119	0.0261	0.1615	1.4149
60 BRIOSCHISVILUPPOIMMBL	0.0019	0.0082	0.0908	-0.0917
61 BEEWIZE	0.0028	0.0361	0.1899	5.0164
62 EXPRIVIA	0.0188	0.0260	0.1613	2.3413
63 AUTOGRILL	0.0075	0.0122	0.1105	1.4552
64 JUVENTUSFOOTBALLCLUB	0.0178	0.0223	0.1495	1.3095
65 SSLAZIO	0.0157	0.0173	0.1316	0.9292
66 CLASSEDITORI	-0.0171	0.0133	0.1154	0.7389
67 BASTOGI	-0.0115	0.0034	0.0584	1.1613

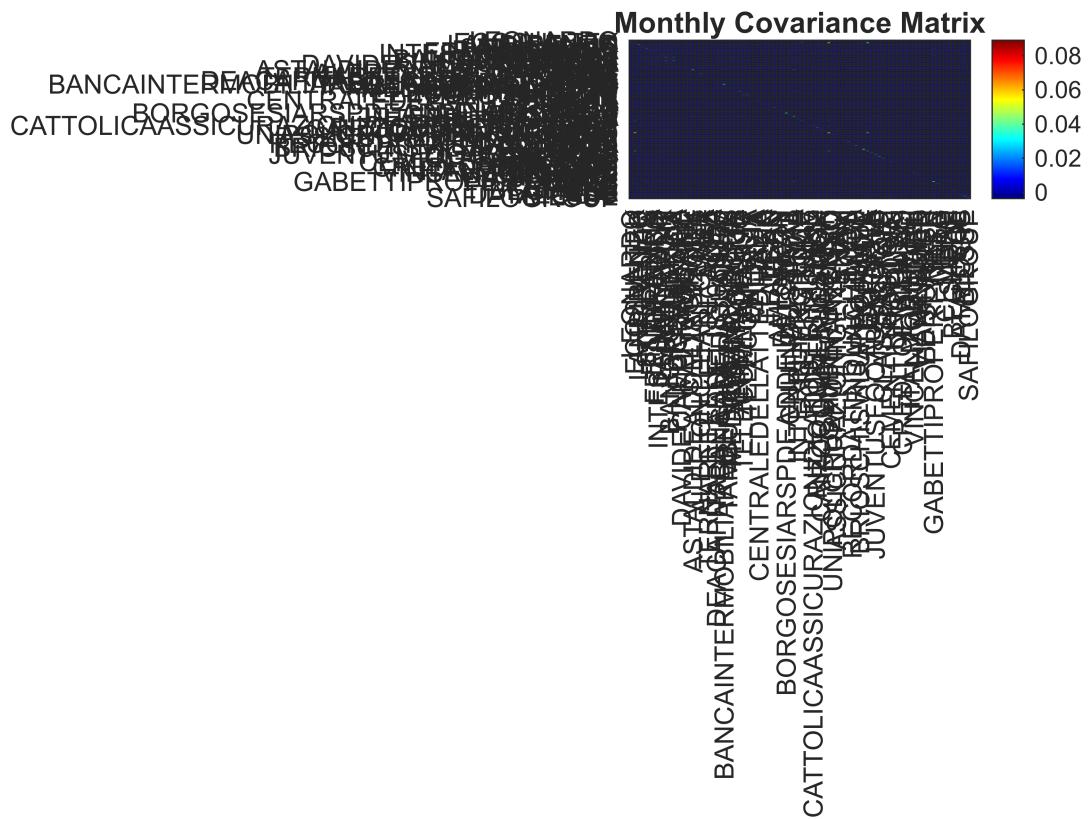
	Mean	Variance	Standard Deviation	Skewness
68 CEMENTIRHOLDING	0.0085	0.0095	0.0976	0.6667
69 UNIPOLSAI	0.0028	0.0051	0.0717	-0.1015
70 BUZZI	0.0106	0.0060	0.0775	-0.1196
71 CREDITOEMILIANO	0.0046	0.0064	0.0803	0.4977
72 DANIELI	0.0044	0.0073	0.0856	-0.1152
73 ITALMOBILIARE	0.0121	0.0054	0.0734	2.0238
74 VINCENZOZUCCHI	-0.0033	0.0097	0.0982	1.6077
75 WEBUILD	0.0004	0.0117	0.1083	0.7516
76 VIANINIINDR	0.0025	0.0031	0.0553	0.5218
77 EDISONRSP	0.0064	0.0032	0.0567	0.2256
78 RATTI	0.0040	0.0036	0.0602	0.2144
79 GABETTIPROPERTYSLTN	0.0143	0.0320	0.1789	2.1151
80 MFEB	-0.0038	0.0144	0.1201	3.1924
81 ERG	0.0129	0.0048	0.0690	0.1416
82 CEMBRE	0.0139	0.0066	0.0813	-0.0831
83 SABAF	0.0070	0.0093	0.0962	0.1974
84 BEGHELLI	-0.0004	0.0087	0.0933	1.3946
85 SOL	0.0156	0.0040	0.0636	0.2947
86 DATALOGIC	0.0036	0.0124	0.1113	0.2691
87 BIESSE	0.0107	0.0164	0.1281	-0.1878
88 SAFILOGROUP	-0.0063	0.0190	0.1380	0.9913

2. Variance-Covariance Matrix

```
vc_daily = cov(returns_daily, 'partialrows'); % Daily Variance-covariance matrix
heatmap(vc_daily,"Colormap",jet(100),"XDisplayLabels",names_of_companies,"YDisplayLabels",names_of_companies,"Title","Daily Covariance Matrix")
```

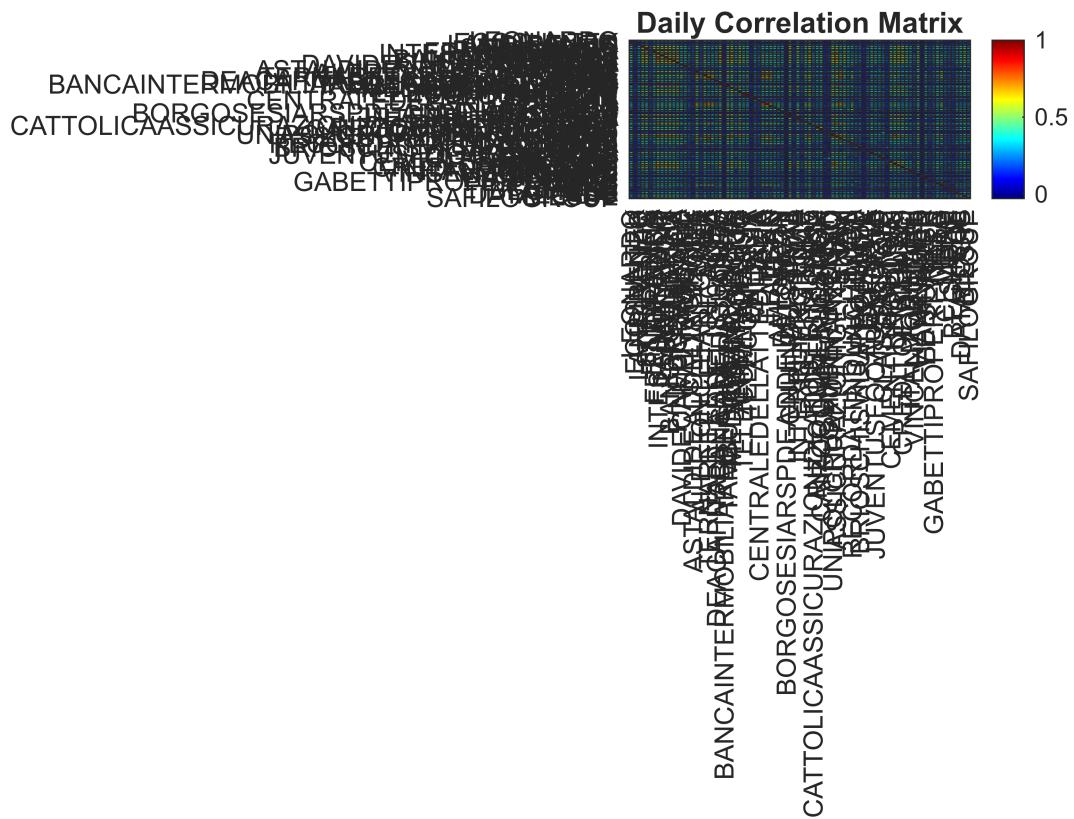


```
vc_monthly = cov(returns_monthly, 'partialrows'); % Monthly Variance-covariance
matrix
heatmap(vc_monthly,"Colormap",jet(100),"XDisplayLabels",names_of_companies,"YDisplay
Labels",names_of_companies,"Title","Monthly Covariance Matrix")
```

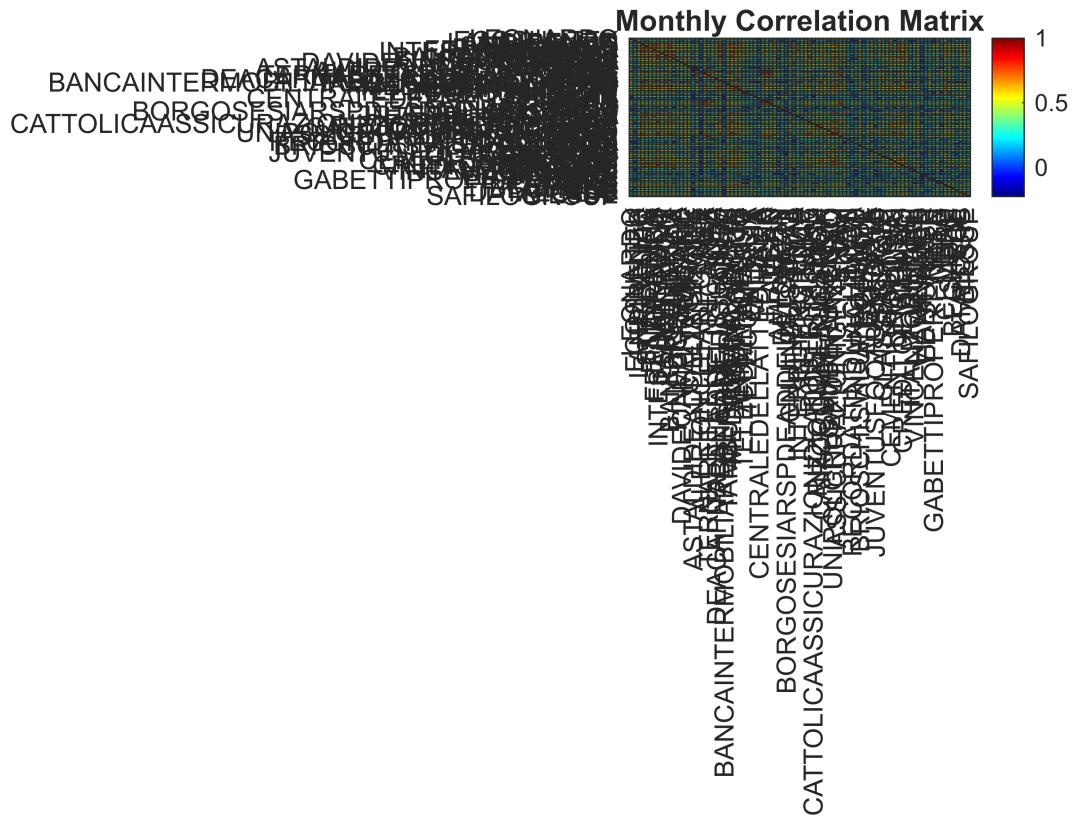


Correlation Matrix

```
corr_daily = corr(returns_daily, "rows","complete"); % Daily correlation matrix
heatmap(corr_daily,"Colormap",jet(100),"XDisplayLabels",names_of_companies,"YDisplay
Labels",names_of_companies,"Title","Daily Correlation Matrix")
```



```
corr_monthly = corr(returns_monthly, "rows", "complete"); % Daily correlation matrix
heatmap(corr_monthly,"Colormap",jet(100),"XDisplayLabels",names_of_companies,"YDisplayLabels",names_of_companies,"Title","Monthly Correlation Matrix")
```



3. Selecting Securities

Deleting delisted companies

```

prices_daily_no_delisted = prices_daily;
prices_daily_no_delisted(:,[41 25 17 23 48]) = [];

prices_monthly_no_delisted = prices_monthly;
prices_monthly_no_delisted(:,[41 25 17 23 48]) = [];

names_of_companies_no_delisted = names_of_companies;
names_of_companies_no_delisted([41 25 17 23 48]) = []

```

Recalculating correlations

```

returns_daily_no_delisted = tick2ret(prices_daily_no_delisted);
returns_monthly_no_delisted = tick2ret(prices_monthly_no_delisted);

corr_daily_no_delisted = corr(returns_daily_no_delisted,"rows","complete");
corr_monthly_no_delisted = corr(returns_monthly_no_delisted,"rows","complete");

```

Selection algorithm

```
matrice_corr = corr_monthly_no_delisted;
```

```

selezionate = [];

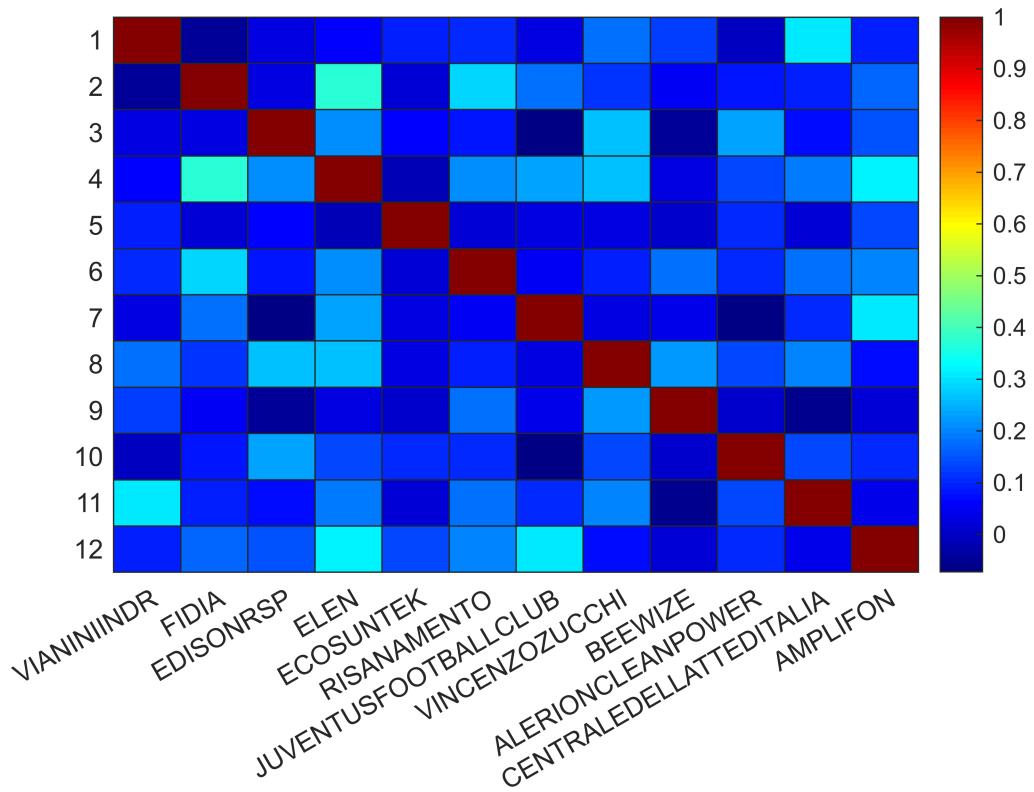
for i = 1:11
    min_corr = inf;

    if i == 1
        [row, col] = find(matrice_corr == min(matrice_corr(:)));
        selezionate = [selezionate, row(1) , col(1)];
    else
        for j = 1:size(matrice_corr, 1)
            if ~ismember(j, selezionate)
                corr_sum = sum(matrice_corr(selezionate, j));
                if corr_sum < min_corr
                    min_corr = corr_sum;
                    var_da_aggiungere = j;
                end
            end
        end
        selezionate = [selezionate, var_da_aggiungere];
    end
end

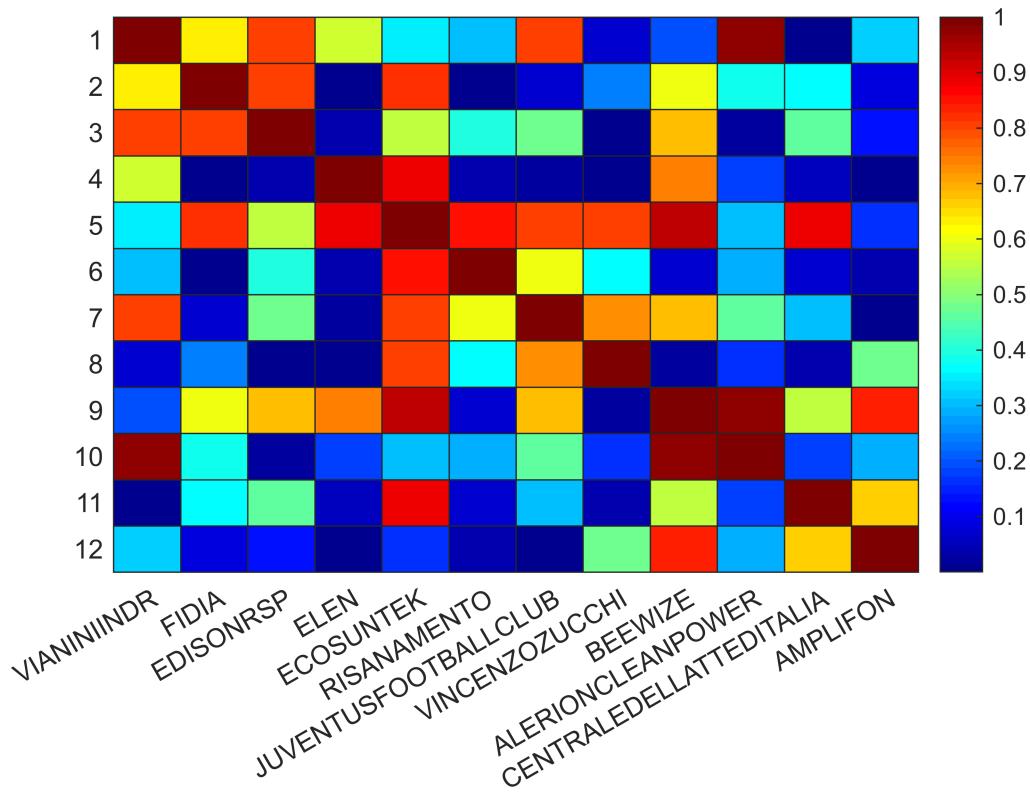
%RECORDATI has some residual correlation, we decide to substitute it with
%the most profitable one --> Elen N°35
m = [71 39 72 35 2 54 59 69 56 18 31 36];

%heatmap portfolio monthly
subselection_monthly = [returns_monthly_no_delisted(:,m)];
corr_monthly_selected = corr(subselection_monthly,"rows","complete");
heatmap(corr_monthly_selected,"Colormap",jet(100),"XDisplayLabels",names_of_companie
s_no_delisted(m))

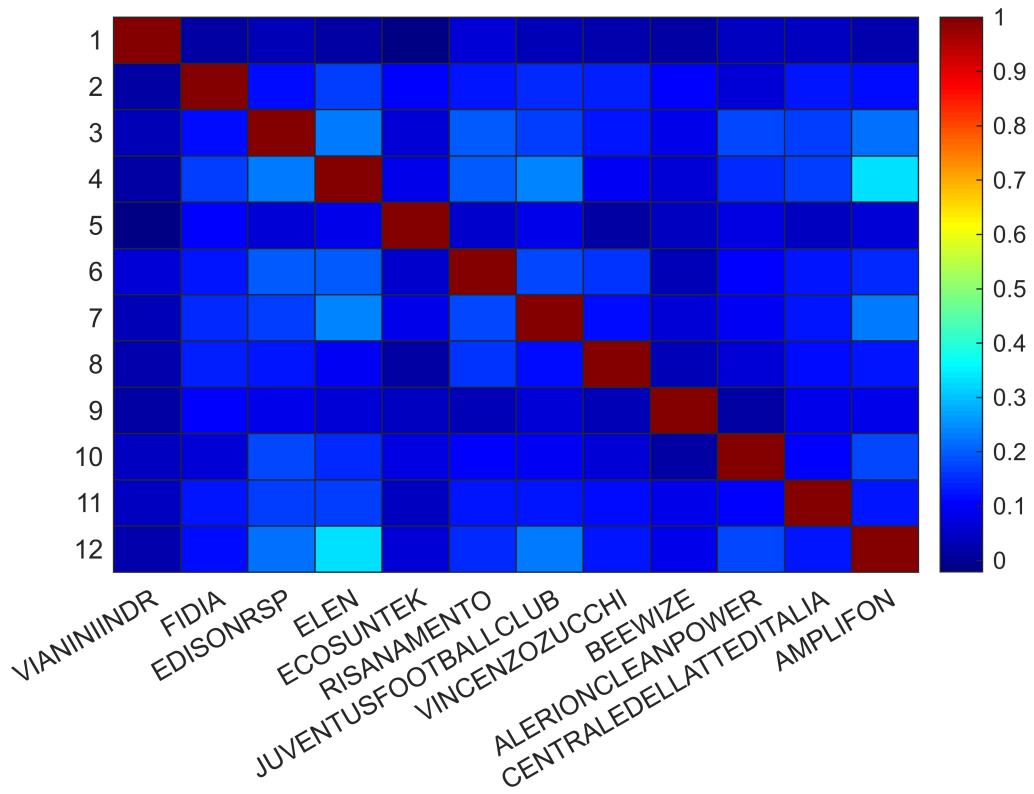
```



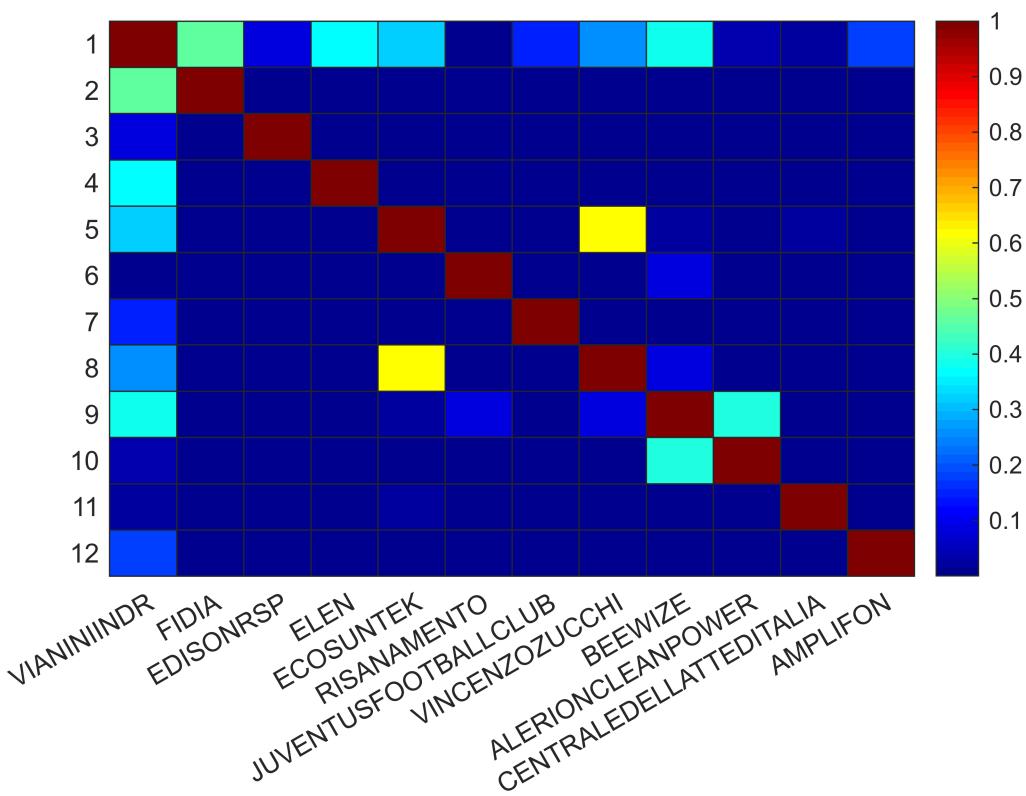
```
[corr_monthly_selected9, p_values]=
corrcoef(subselection_monthly,"rows","complete");
heatmap(p_values,"Colormap",jet(64),"XDisplayLabels",names_of_companies_no_delisted(
m))
```



```
%heatmap portfolio daily
subselection_daily = [returns_daily_no_delisted(:,m)];
corr_daily_selected = corr(subselection_daily,"rows","complete");
heatmap(corr_daily_selected,"Colormap",jet(100),"XDisplayLabels",names_of_companies_
no_delisted(m))
```



```
[corr_daily_selected9, p_values]= corrcoef(subselection_daily,"rows","complete");
heatmap(p_values,"Colormap",jet(64),"XDisplayLabels",names_of_companies_no_delisted(m))
```



Defining our porfolio

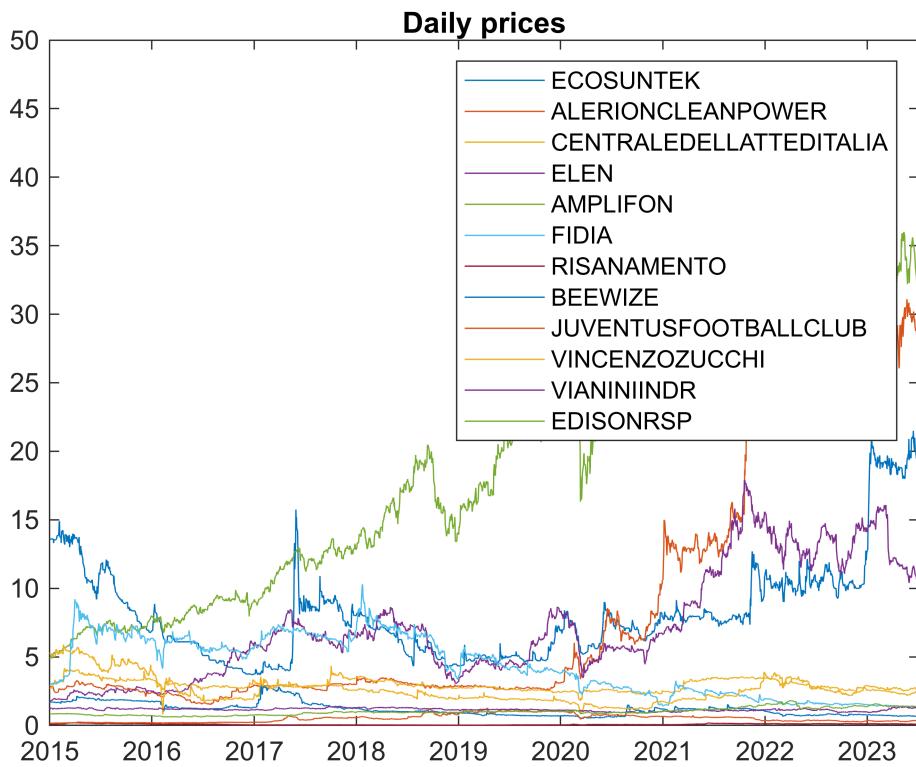
```
selected_securities = sort(m);
namelist = names_of_companies_no_delisted(selected_securities)
```

namelist = 1x12 string
 "ECOSUNTEK" "ALERIONCLEANP..." "CENTRALEDELLATTEDIT..." "ELEN" "AMPLIFON" "...

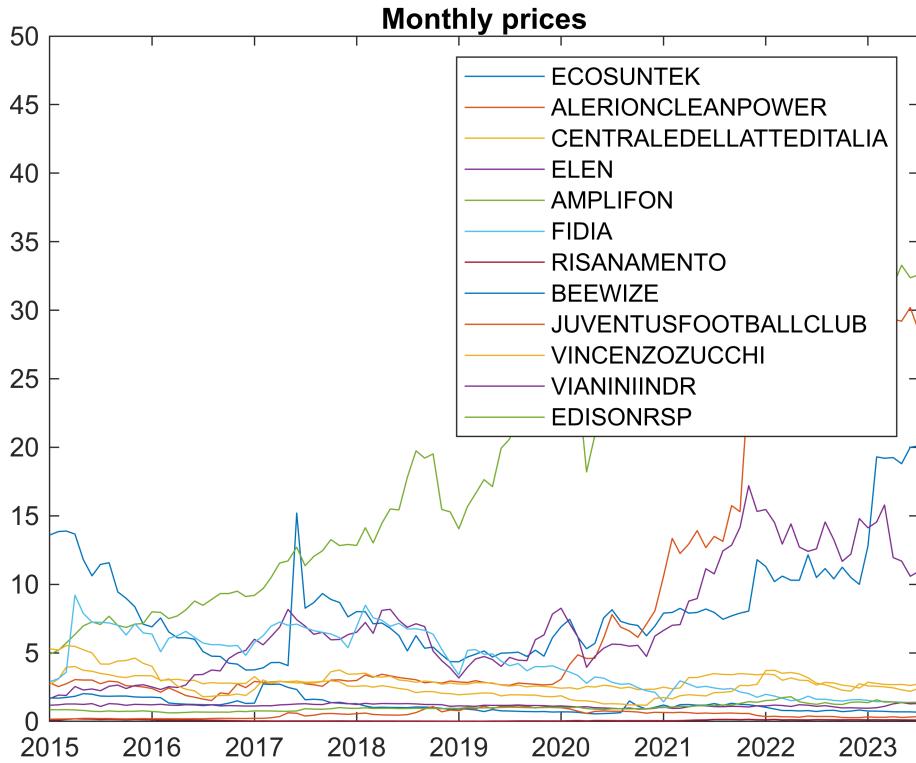
```
% The return series for only our selected companies
selected_returns_daily = returns_daily_no_delisted(:,selected_securities);
selected_returns_monthly = returns_monthly_no_delisted(:,selected_securities);
```

4. Daily plot

```
plot(date_daily,prices_daily_no_delisted(:,selected_securities))
legend(namelist)
title("Daily prices")
```



```
plot(date_monthly,prices_monthly_no_delisted(:,selected_securities))
legend(namelist)
title("Monthly prices")
```



5. 6. Mean-Variance Optimal Portfolio

Daily, no constraints

```
port_MV_daily = Portfolio("AssetList", namelist, "NumAssets", 12, "LowerBudget", 1,
"UpperBudget",1); % The MV portfolio object
port_MV_daily = estimateAssetMoments(port_MV_daily,selected_returns_daily);
port_MV_daily = setBounds(port_MV_daily, -1, 1); % We allow weights to be negative

MV_weight_sharpe_daily = estimateMaxSharpeRatio(port_MV_daily); % We compute the MV
optimal weights that maximise the Sharpe Ratio
[wMvd_sigma_sharpe, wMvd_returns_sharpe] =
estimatePortMoments(port_MV_daily,MV_weight_sharpe_daily);
```

Monthly, no constraints

```
port_MV_monthly = Portfolio("AssetList", namelist, "NumAssets", 12, "LowerBudget",
1, "UpperBudget",1); % The MV portfolio object
port_MV_monthly = estimateAssetMoments(port_MV_monthly,selected_returns_monthly);
port_MV_monthly = setBounds(port_MV_monthly, -1, 1); % We allow weights to be
negative

MV_weight_sharpe_monthly = estimateMaxSharpeRatio(port_MV_monthly); % We compute
the MV optimal weights that maximise the Sharpe Ratio
[wMVm_sigma_sharpe, wMVm_returns_sharpe] =
estimatePortMoments(port_MV_monthly,MV_weight_sharpe_monthly);
```

```
summary_table_MV_weights =
table(MV_weight_sharpe_daily,MV_weight_sharpe_monthly,'RowNames',namelist,'VariableNames',[ "Weights daily" "Weights monthly"])
```

summary_table_MV_weights = 12x2 table

	Weights daily	Weights monthly
1 ECOSUNTEK	0.0789	0.0246
2 ALERIONCLEANPOWER	0.3201	0.3243
3 CENTRALEDELLATTEDITALIA	-0.0433	-0.0460
4 ELEN	0.2394	0.2346
5 AMPLIFON	0.3218	0.4029
6 FIDIA	-0.0544	-0.0725
7 RISANAMENTO	-0.0007	0.0023
8 BEEWIZE	-0.0164	0.0326
9 JUVENTUSFOOTBALLCLUB	0.0643	0.0819
10 VINCENZOZUCCHI	-0.0052	-0.2663
11 VIANINIINDR	0.0918	0.1226
12 EDISONRSP	0.0037	0.1589

```
summary_table_MV_returns_percentage =
table(wMvd_sigma_sharpe.*100,wMvd_returns_sharpe.*100,wMvm_sigma_sharpe.*100,wMvm_returns_sharpe.*100,'VariableNames',[ "Std daily" "Return daily" "Std monthly" "Return monthly"])
```

summary_table_MV_returns_percentage = 1x4 table

	Std daily	Return daily	Std monthly	Return monthly
1	1.4787	0.1147	7.4827	2.8921

Daily, constraints

```
port_MV_daily_c = Portfolio("AssetList", namelist, "NumAssets", 12, "LowerBudget", 1, "UpperBudget",1); % The MV portfolio object
port_MV_daily_c = estimateAssetMoments(port_MV_daily_c,selected_returns_daily);
port_MV_daily_c = setDefaultConstraints(port_MV_daily_c); % We do not allow weights to be negative

MV_weight_sharpe_daily_c = estimateMaxSharpeRatio(port_MV_daily_c); % We compute the MV optimal weights that maximise the Sharpe Ratio
[wMvd_sigma_sharpe_c, wMvd_returns_sharpe_c] = estimatePortMoments(port_MV_daily_c,MV_weight_sharpe_daily_c);
```

Monthly, constraints

```

port_MV_monthly_c = Portfolio("AssetList", namelist, "NumAssets", 12,
"LowerBudget", 1, "UpperBudget",1); % The MV portfolio object
port_MV_monthly_c =
estimateAssetMoments(port_MV_monthly_c,selected_returns_monthly);
port_MV_monthly_c = setDefaultConstraints(port_MV_monthly_c); % We do not allow
weights to be negative

MV_weight_sharpe_monthly_c = estimateMaxSharpeRatio(port_MV_monthly_c); % We
compute the MV optimal weights that maximise the Sharpe Ratio
[wMVm_sigma_sharpe_c, wMVm_returns_sharpe_c] =
estimatePortMoments(port_MV_monthly_c,MV_weight_sharpe_monthly_c);

```

```

summary_table_MV_weights_c =
table(MV_weight_sharpe_daily_c,MV_weight_sharpe_monthly_c,'RowNames',namelist,'VariableNames',[ "Weights daily" "Weights monthly"])

```

summary_table_MV_weights_c = 12x2 table

	Weights daily	Weights monthly
1 ECOSUNTEK	0.0685	0.0213
2 ALERIONCLEANPOWER	0.2954	0.2758
3 CENTRALEDELLATTEDITALIA	0	0
4 ELEN	0.2102	0.1375
5 AMPLIFON	0.2929	0.3826
6 FIDIA	0	0
7 RISANAMENTO	0	0
8 BEEWIZE	0	0.0031
9 JUVENTUSFOOTBALLCLUB	0.0503	0.0630
10 VINCENZOZUCCHI	0	0
11 VIANINIINDR	0.0826	0.0532
12 EDISONRSP	0	0.0634

```

summary_table_MV_returns_percentage_c =
table(wMVs_sigma_sharpe_c.*100,wMVs_returns_sharpe_c.*100,wMVm_sigma_sharpe_c.*100,w
MVm_returns_sharpe_c.*100,'VariableNames',[ "Std daily" "Return daily" "Std monthly"
"Return monthly"])

```

summary_table_MV_returns_percentage_c = 1x4 table

	Std daily	Return daily	Std monthly	Return monthly
1	1.3673	0.1050	6.3425	2.2736

7. Summary statistics on Optimal Portfolios

```

MV_weighted_returns_daily = selected_returns_daily*MV_weight_sharpe_daily;
MV_mean_daily = mean(MV_weighted_returns_daily);

```

```

MV_std_daily = std(MV_weighted_returns_daily);
MV_var_daily = var(MV_weighted_returns_daily);
MV_skew_daily = skewness(MV_weighted_returns_daily);
MV_kurt_daily = kurtosis(MV_weighted_returns_daily);
MV_Sharpe_daily = sharpe(MV_weighted_returns_daily);

```

Warning: No Cash return specified. Will assume return is 0.

```

MV_weighted_returns_monthly = selected_returns_monthly*MV_weight_sharpe_monthly;
MV_mean_monthly = mean(MV_weighted_returns_monthly);
MV_std_monthly = std(MV_weighted_returns_monthly);
MV_var_monthly = var(MV_weighted_returns_monthly);
MV_skew_monthly = skewness(MV_weighted_returns_monthly);
MV_kurt_monthly = kurtosis(MV_weighted_returns_monthly);
MV_Sharpe_monthly = sharpe(MV_weighted_returns_monthly);

```

Warning: No Cash return specified. Will assume return is 0.

```

MV_weighted_returns_daily_c = selected_returns_daily*MV_weight_sharpe_daily_c;
MV_mean_daily_c = mean(MV_weighted_returns_daily_c);
MV_std_daily_c = std(MV_weighted_returns_daily_c);
MV_var_daily_c = var(MV_weighted_returns_daily_c);
MV_skew_daily_c = skewness(MV_weighted_returns_daily_c);
MV_kurt_daily_c = kurtosis(MV_weighted_returns_daily_c);
MV_Sharpe_daily_c = sharpe(MV_weighted_returns_daily_c);

```

Warning: No Cash return specified. Will assume return is 0.

```

MV_weighted_returns_monthly_c = selected_returns_monthly*MV_weight_sharpe_monthly_c;
MV_mean_monthly_c = mean(MV_weighted_returns_monthly_c);
MV_std_monthly_c = std(MV_weighted_returns_monthly_c);
MV_var_monthly_c = var(MV_weighted_returns_monthly_c);
MV_skew_monthly_c = skewness(MV_weighted_returns_monthly_c);
MV_kurt_monthly_c = kurtosis(MV_weighted_returns_monthly_c);
MV_Sharpe_monthly_c = sharpe(MV_weighted_returns_monthly_c);

```

Warning: No Cash return specified. Will assume return is 0.

```

summary_table_MV_statistics = table([MV_mean_daily MV_mean_monthly MV_mean_daily_c
MV_mean_monthly_c], ...
[MV_std_daily MV_std_monthly MV_std_daily_c MV_std_monthly_c],[MV_var_daily
MV_var_monthly MV_var_daily_c MV_var_monthly_c], ...
[MV_skew_daily MV_skew_monthly MV_skew_daily_c MV_skew_monthly_c],
[MV_kurt_daily MV_kurt_monthly MV_kurt_daily_c MV_kurt_monthly_c], ...
[MV_Sharpe_daily MV_Sharpe_monthly MV_Sharpe_daily_c
MV_Sharpe_monthly_c],'RowNames',[ "Daily, no constraints" "Monthly, no constraints"
"Daily, constrained" "Monthly, constrained"],'VariableNames', ...
[ "Mean" "Standard deviation" "Variance" "Skewness" "Kurtosis" "Sharpe Ratio"])

```

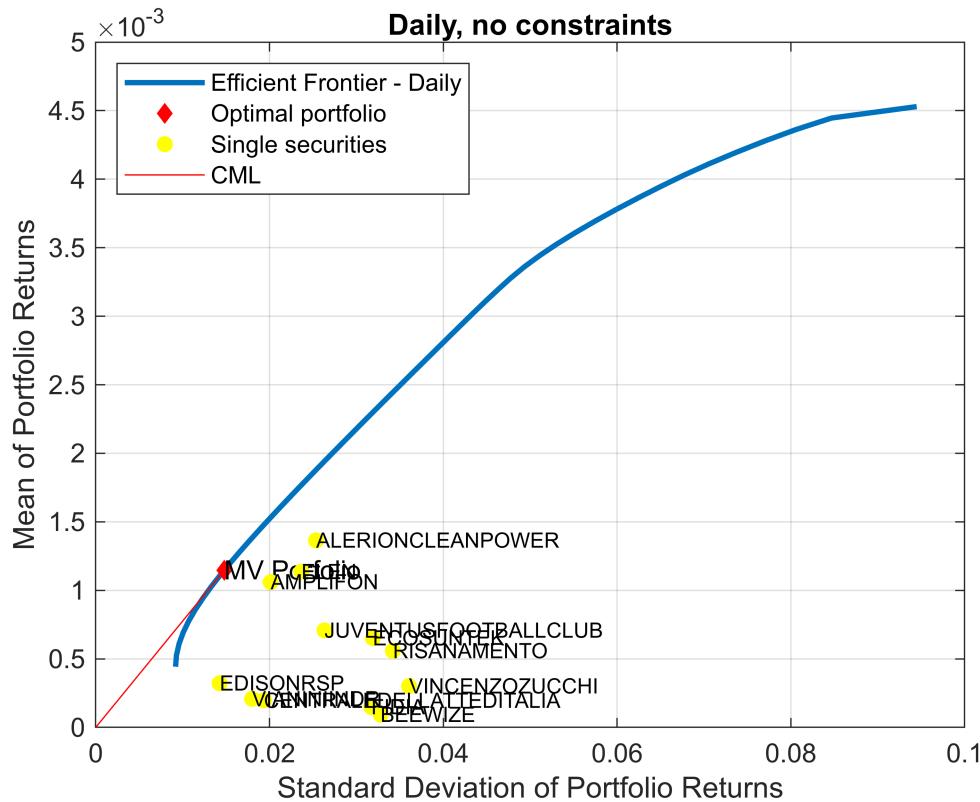
```
summary_table_MV_statistics = 4x6 table
```

	Mean	Standard deviation	Variance	Skewness
1 Daily, no constraints	0.0011	0.0148	0.0002	-0.1990
2 Monthly, no constraints	0.0289	0.0748	0.0056	0.0894
3 Daily, constrained	0.0010	0.0137	0.0002	-0.2901
4 Monthly, constrained	0.0227	0.0634	0.0040	-0.0670

8. Plotting the Efficient Frontier

```
% Daily
```

```
eff_frontier_daily = plotFrontier(port_MV_daily,50);
hold on
scatter(MV_std_daily,MV_mean_daily,"filled","diamond","red")
text(MV_std_daily,MV_mean_daily,"MV Porfolio")
scatter(sqrt(diag(port_MV_daily.AssetCovar)),port_MV_daily.AssetMean,"filled","yellow")
text(sqrt(diag(port_MV_daily.AssetCovar)),port_MV_daily.AssetMean,namelist,"FontSize",8)
title("Daily, no constraints")
line([0 MV_std_daily],[0 MV_mean_daily],'Color','red')
legend('Efficient Frontier - Daily','Optimal portfolio','Single securities','CML','Location','northwest')
hold off
```

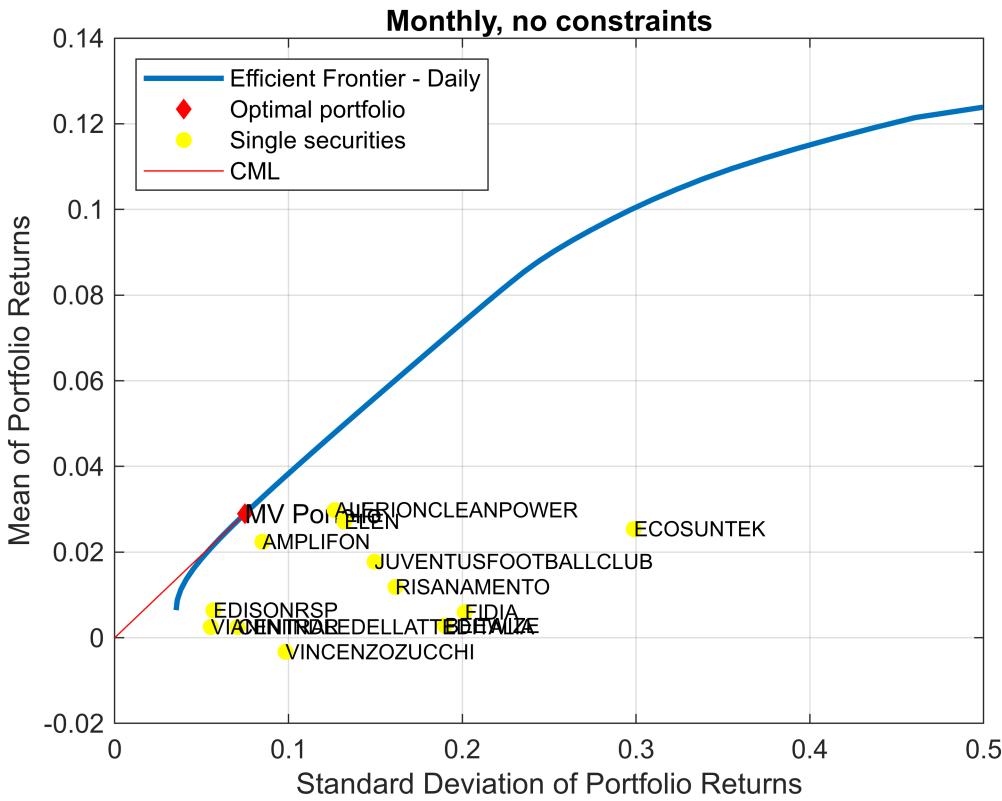


% Monthly

```

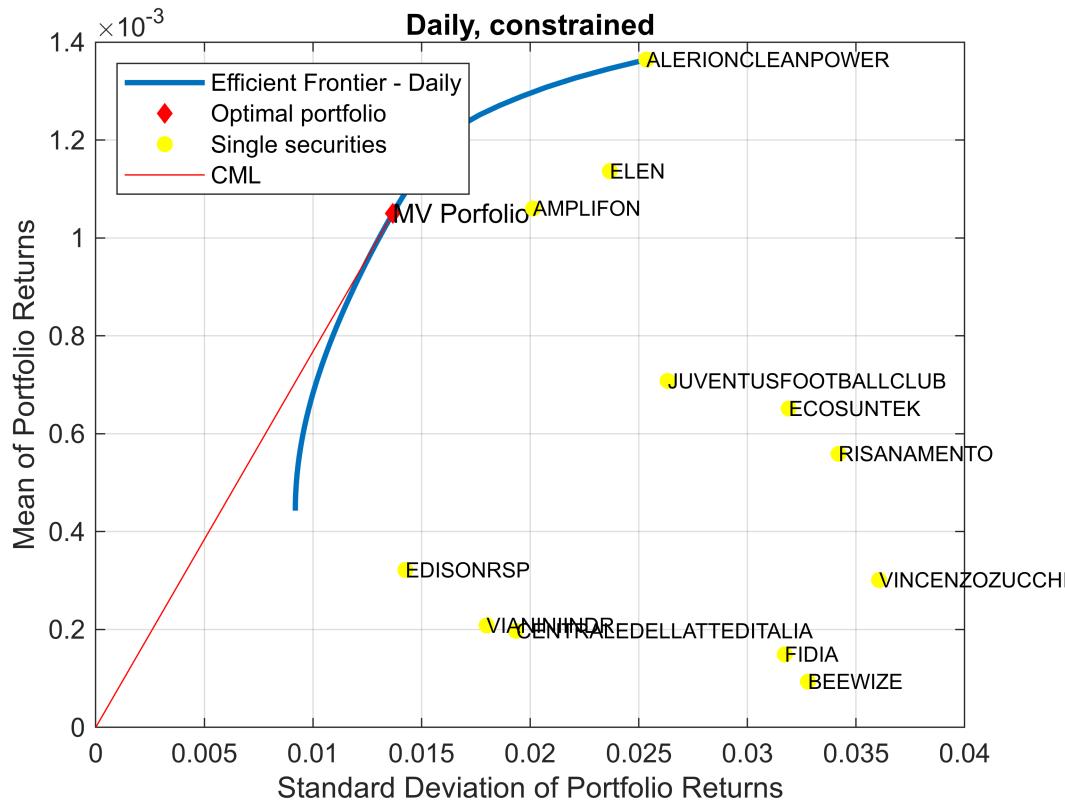
eff_frontier_monthly = plotFrontier(port_MV_monthly,50);
hold on
scatter(MV_std_monthly,MV_mean_monthly,"filled","diamond","red")
text(MV_std_monthly,MV_mean_monthly,"MV Porfolio")
scatter(sqrt(diag(port_MV_monthly.AssetCovar)),port_MV_monthly.AssetMean,"filled","yellow")
text(sqrt(diag(port_MV_monthly.AssetCovar)),port_MV_monthly.AssetMean,namelist,"FontSize",8)
title("Monthly, no constraints")
line([0 MV_std_monthly],[0 MV_mean_monthly],'Color','red')
legend('Efficient Frontier - Daily','Optimal portfolio','Single securities','CML','Location','northwest')
hold off

```



```
% Daily constrained
```

```
eff_frontier_daily_c = plotFrontier(port_MV_daily_c,50);
hold on
scatter(MV_std_daily_c,MV_mean_daily_c,"filled","diamond","red")
text(MV_std_daily_c,MV_mean_daily_c,"MV Porfolio")
scatter(sqrt(diag(port_MV_daily_c.AssetCovar)),port_MV_daily_c.AssetMean,"filled","yellow")
text(sqrt(diag(port_MV_daily_c.AssetCovar)),port_MV_daily_c.AssetMean,namelist,"FontSize",8)
title("Daily, constrained")
line([0 MV_std_daily_c],[0 MV_mean_daily_c],'Color','red')
legend('Efficient Frontier - Daily','Optimal portfolio','Single securities','CML','Location','northwest')
hold off
```

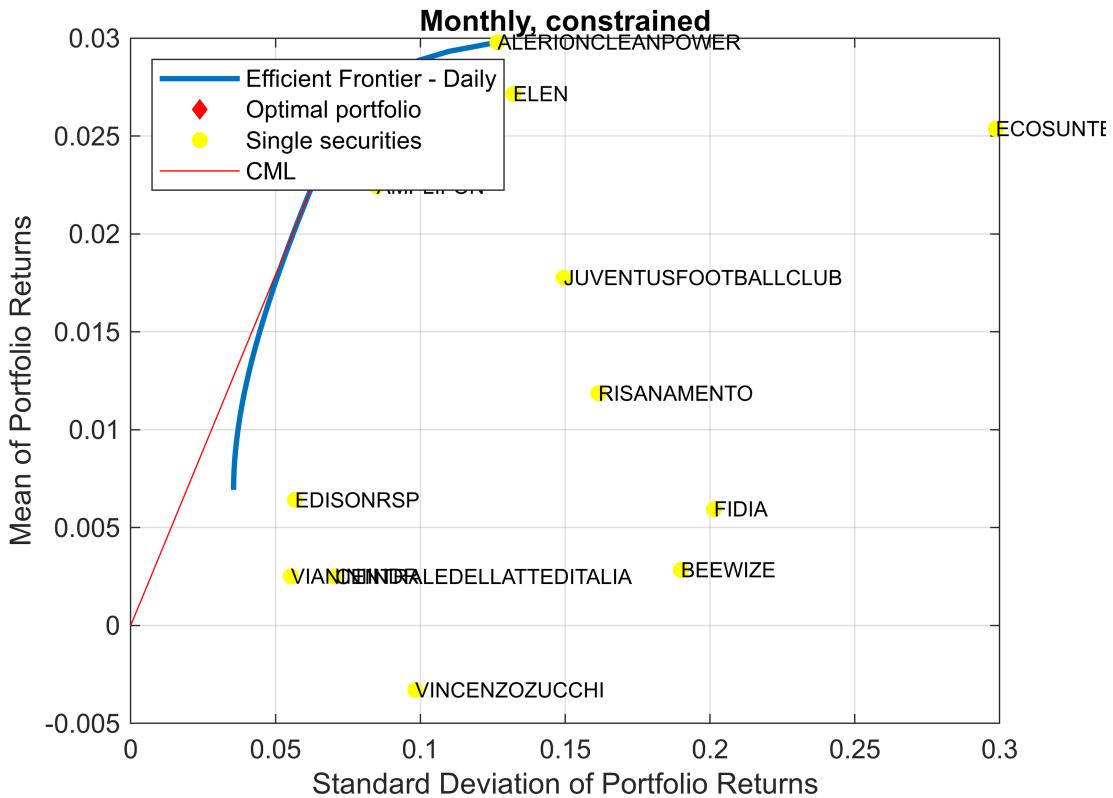


% Monthly constrained

```

eff_frontier_monthly_c = plotFrontier(port_MV_monthly_c,50);
hold on
scatter(MV_std_monthly_c,MV_mean_monthly_c,"filled","diamond","red")
text(MV_std_monthly_c,MV_mean_monthly_c,"MV Porfolio")
scatter(sqrt(diag(port_MV_monthly_c.AssetCovar)),port_MV_monthly_c.AssetMean,"filled
","yellow")
text(sqrt(diag(port_MV_monthly_c.AssetCovar)),port_MV_monthly_c.AssetMean,namelist,
FontSize",8)
title("Monthly, constrained")
line([0 MV_std_monthly_c],[0 MV_mean_monthly_c], 'Color', 'red')
legend('Efficient Frontier - Daily','Optimal portfolio','Single
securities','CML','Location','northwest')
hold off

```



Importing Data for index

Set up the Import Options and import the data for daily data

```

opts = spreadsheetImportOptions("NumVariables", 5);

% Specify sheet and range
opts.Sheet = "daily";
opts.DataRange = "A4:E2222";

% Specify column names and types
opts.VariableNames = ["Name", "Var2", "Var3", "Var4",
"FTSEITALIAALLSHARETOTRETURNIND"];
opts.SelectedVariableNames = ["Name", "FTSEITALIAALLSHARETOTRETURNIND"];
opts.VariableTypes = ["datetime", "char", "char", "char", "double"];

% Specify variable properties
opts = setvaropts(opts, ["Var2", "Var3", "Var4"], "WhitespaceRule", "preserve");
opts = setvaropts(opts, ["Var2", "Var3", "Var4"], "EmptyFieldRule", "auto");

% Import the data
FTSE_import_daily = readtable("C:\Users\Diego\MATLAB Drive\Exam 2023\Dati per
l'esame\addendum data.xlsx", opts, "UseExcel", false)

FTSE_import_daily = 2219x2 table

```

	Name	FTSEITALIAALLSHARETOTRETURNIND
1	01-Jan-2015	2.4980e+04
2	02-Jan-2015	2.5151e+04
3	05-Jan-2015	2.4027e+04
4	06-Jan-2015	2.3941e+04
5	07-Jan-2015	2.3904e+04
6	08-Jan-2015	2.4715e+04
7	09-Jan-2015	2.3980e+04
8	12-Jan-2015	2.4169e+04
9	13-Jan-2015	2.4623e+04
10	14-Jan-2015	2.4276e+04
11	15-Jan-2015	2.4799e+04
12	16-Jan-2015	2.5294e+04
13	19-Jan-2015	2.5615e+04
14	20-Jan-2015	2.5848e+04
15	21-Jan-2015	2.6249e+04
16	22-Jan-2015	2.6866e+04
17	23-Jan-2015	2.6958e+04
18	26-Jan-2015	2.7289e+04
19	27-Jan-2015	2.7160e+04
20	28-Jan-2015	2.6961e+04
21	29-Jan-2015	2.7094e+04
22	30-Jan-2015	2.7011e+04
23	02-Feb-2015	2.7005e+04
24	03-Feb-2015	2.7663e+04
25	04-Feb-2015	2.7596e+04
26	05-Feb-2015	2.7478e+04
27	06-Feb-2015	2.7409e+04
28	09-Feb-2015	2.6929e+04
29	10-Feb-2015	2.7392e+04
30	11-Feb-2015	2.7181e+04
31	12-Feb-2015	2.7747e+04
32	13-Feb-2015	2.7979e+04
33	16-Feb-2015	2.7942e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
34	17-Feb-2015	2.8069e+04
35	18-Feb-2015	2.8556e+04
36	19-Feb-2015	2.8730e+04
37	20-Feb-2015	2.8800e+04
38	23-Feb-2015	2.8949e+04
39	24-Feb-2015	2.9180e+04
40	25-Feb-2015	2.8925e+04
41	26-Feb-2015	2.9251e+04
42	27-Feb-2015	2.9466e+04
43	02-Mar-2015	2.9436e+04
44	03-Mar-2015	2.9038e+04
45	04-Mar-2015	2.9225e+04
46	05-Mar-2015	2.9595e+04
47	06-Mar-2015	2.9684e+04
48	09-Mar-2015	2.9849e+04
49	10-Mar-2015	2.9582e+04
50	11-Mar-2015	3.0190e+04
51	12-Mar-2015	3.0175e+04
52	13-Mar-2015	3.0085e+04
53	16-Mar-2015	3.0363e+04
54	17-Mar-2015	3.0071e+04
55	18-Mar-2015	2.9864e+04
56	19-Mar-2015	3.0169e+04
57	20-Mar-2015	3.0624e+04
58	23-Mar-2015	3.0515e+04
59	24-Mar-2015	3.0875e+04
60	25-Mar-2015	3.0666e+04
61	26-Mar-2015	3.0366e+04
62	27-Mar-2015	3.0442e+04
63	30-Mar-2015	3.0816e+04
64	31-Mar-2015	3.0691e+04
65	01-Apr-2015	3.0946e+04
66	02-Apr-2015	3.0906e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
67	03-Apr-2015	3.0906e+04
68	06-Apr-2015	3.0906e+04
69	07-Apr-2015	3.1400e+04
70	08-Apr-2015	3.1261e+04
71	09-Apr-2015	3.1555e+04
72	10-Apr-2015	3.1683e+04
73	13-Apr-2015	3.1871e+04
74	14-Apr-2015	3.1523e+04
75	15-Apr-2015	3.1870e+04
76	16-Apr-2015	3.1314e+04
77	17-Apr-2015	3.0557e+04
78	20-Apr-2015	3.0951e+04
79	21-Apr-2015	3.0834e+04
80	22-Apr-2015	3.0915e+04
81	23-Apr-2015	3.0747e+04
82	24-Apr-2015	3.1041e+04
83	27-Apr-2015	3.1539e+04
84	28-Apr-2015	3.1211e+04
85	29-Apr-2015	30517
86	30-Apr-2015	30586
87	01-May-2015	30586
88	04-May-2015	3.0792e+04
89	05-May-2015	2.9982e+04
90	06-May-2015	3.0066e+04
91	07-May-2015	3.0306e+04
92	08-May-2015	3.0914e+04
93	11-May-2015	3.0959e+04
94	12-May-2015	3.0686e+04
95	13-May-2015	3.0810e+04
96	14-May-2015	3.1215e+04
97	15-May-2015	3.1135e+04
98	18-May-2015	3.1266e+04
99	19-May-2015	3.1920e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
100	20-May-2015	3.2007e+04
	:	

Clear temporary variables

```
clear opts
```

Set up the Import Options and import the data for monthly data

```
opts = spreadsheetImportOptions("NumVariables", 5);

% Specify sheet and range
opts.Sheet = "monthly";
opts.DataRange = "A4:E106";

% Specify column names and types
opts.VariableNames = ["Name", "Var2", "Var3", "Var4",
"FTSEITALIAALLSHARETOTRETURNIND"];
opts.SelectedVariableNames = ["Name", "FTSEITALIAALLSHARETOTRETURNIND"];
opts.VariableTypes = ["datetime", "char", "char", "char", "double"];

% Specify variable properties
opts = setvaropts(opts, ["Var2", "Var3", "Var4"], "WhitespaceRule", "preserve");
opts = setvaropts(opts, ["Var2", "Var3", "Var4"], "EmptyFieldRule", "auto");

% Import the data
FTSE_import_monthly = readtable("C:\Users\Diego\MATLAB Drive\Exam 2023\Dati per
l'esame\addendum data.xlsx", opts, "UseExcel", false)
```

FTSE_import_monthly = 103x2 table

	Name	FTSEITALIAALLSHARETOTRETURNIND
1	01-Jan-2015	2.4980e+04
2	01-Feb-2015	2.7005e+04
3	01-Mar-2015	2.9436e+04
4	01-Apr-2015	3.0946e+04
5	01-May-2015	30586
6	01-Jun-2015	3.1571e+04
7	01-Jul-2015	3.1029e+04
8	01-Aug-2015	3.2267e+04
9	01-Sep-2015	2.9229e+04
10	01-Oct-2015	2.8862e+04
11	01-Nov-2015	3.0730e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
12	01-Dec-2015	3.1003e+04
13	01-Jan-2016	2.9593e+04
14	01-Feb-2016	2.5714e+04
15	01-Mar-2016	2.5042e+04
16	01-Apr-2016	2.4795e+04
17	01-May-2016	2.5700e+04
18	01-Jun-2016	2.5563e+04
19	01-Jul-2016	2.3526e+04
20	01-Aug-2016	2.3946e+04
21	01-Sep-2016	2.4411e+04
22	01-Oct-2016	2.3654e+04
23	01-Nov-2016	2.4490e+04
24	01-Dec-2016	2.4695e+04
25	01-Jan-2017	2.8178e+04
26	01-Feb-2017	2.7230e+04
27	01-Mar-2017	2.8140e+04
28	01-Apr-2017	2.9622e+04
29	01-May-2017	3.0398e+04
30	01-Jun-2017	3.1391e+04
31	01-Jul-2017	3.1404e+04
32	01-Aug-2017	3.2404e+04
33	01-Sep-2017	3.2758e+04
34	01-Oct-2017	3.4259e+04
35	01-Nov-2017	3.4617e+04
36	01-Dec-2017	3.3345e+04
37	01-Jan-2018	3.3009e+04
38	01-Feb-2018	3.5460e+04
39	01-Mar-2018	3.3688e+04
40	01-Apr-2018	3.3736e+04
41	01-May-2018	3.6047e+04
42	01-Jun-2018	3.3931e+04
43	01-Jul-2018	3.3061e+04
44	01-Aug-2018	3.3796e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
45	01-Sep-2018	3.1759e+04
46	01-Oct-2018	3.2117e+04
47	01-Nov-2018	2.9713e+04
48	01-Dec-2018	3.0344e+04
49	01-Jan-2019	2.8407e+04
50	01-Feb-2019	30454
51	01-Mar-2019	3.2172e+04
52	01-Apr-2019	3.3341e+04
53	01-May-2019	3.4055e+04
54	01-Jun-2019	3.1626e+04
55	01-Jul-2019	3.3789e+04
56	01-Aug-2019	3.4334e+04
57	01-Sep-2019	3.4069e+04
58	01-Oct-2019	3.4982e+04
59	01-Nov-2019	3.6529e+04
60	01-Dec-2019	3.6564e+04
61	01-Jan-2020	3.7627e+04
62	01-Feb-2020	3.7593e+04
63	01-Mar-2020	3.4641e+04
64	01-Apr-2020	2.6616e+04
65	01-May-2020	2.8520e+04
66	01-Jun-2020	3.0134e+04
67	01-Jul-2020	3.1463e+04
68	01-Aug-2020	3.1736e+04
69	01-Sep-2020	3.2065e+04
70	01-Oct-2020	3.1336e+04
71	01-Nov-2020	3.0077e+04
72	01-Dec-2020	3.6055e+04
73	01-Jan-2021	3.6314e+04
74	01-Feb-2021	3.5863e+04
75	01-Mar-2021	3.8129e+04
76	01-Apr-2021	4.0525e+04
77	01-May-2021	4.0331e+04

	Name	FTSEITALIAALLSHARETOTRETURNIND
78	01-Jun-2021	4.2285e+04
79	01-Jul-2021	4.2313e+04
80	01-Aug-2021	42692
81	01-Sep-2021	4.4102e+04
82	01-Oct-2021	4.3184e+04
83	01-Nov-2021	4.6046e+04
84	01-Dec-2021	4.4862e+04
85	01-Jan-2022	4.7061e+04
86	01-Feb-2022	4.6181e+04
87	01-Mar-2022	4.1420e+04
88	01-Apr-2022	4.2730e+04
89	01-May-2022	4.1050e+04
90	01-Jun-2022	4.2351e+04
91	01-Jul-2022	3.7403e+04
92	01-Aug-2022	3.9471e+04
93	01-Sep-2022	3.7428e+04
94	01-Oct-2022	3.6712e+04
95	01-Nov-2022	3.9811e+04
96	01-Dec-2022	4.3315e+04
97	01-Jan-2023	4.2422e+04
98	01-Feb-2023	4.7056e+04
99	01-Mar-2023	4.8110e+04
100	01-Apr-2023	4.7861e+04
⋮		

Clear temporary variables

```
clear opts
```

Data handling for index

Daily

```
date_index_daily = table2array(FTSE_import_daily(:,1));
index_daily = table2array(FTSE_import_daily(:,2:end));
```

```
% Calculate returns
```

```
index_returns_daily = tick2ret(index_daily);
```

Monthly

```
date_index_monthly = table2array(FTSE_import_monthly(:,1));
index_monthly = table2array(FTSE_import_monthly(:,2:end));
```

```
% Calculate returns
index_returns_monthly = tick2ret(index_monthly);
```

9. Descriptive statistics for index

Daily

```
mean_index_daily = mean(index_returns_daily, "omitmissing"); % Mean of index
var_index_daily = var(index_returns_daily, "omitmissing"); % Variance of index
std_index_daily = std(index_returns_daily, "omitmissing"); % Standard deviation of index
skewness_index_daily = skewness(index_returns_daily); % Skewness of index
kurtosis_index_daily = kurtosis(index_returns_daily); % Kurtosis of index
```

Monthly

```
mean_index_monthly = mean(index_returns_monthly, "omitmissing"); % Mean of index
var_index_monthly = var(index_returns_monthly, "omitmissing"); % Variance of index
std_index_monthly = std(index_returns_monthly, "omitmissing"); % Standard deviation of index
skewness_index_monthly = skewness(index_returns_monthly); % Skewness of index
kurtosis_index_monthly = kurtosis(index_returns_monthly); % Kurtosis of index
```

```
% Table complete
summary_statistics_index = table([mean_index_daily mean_index_monthly],
[var_index_daily var_index_monthly],[std_index_daily std_index_monthly], ...
[skewness_index_daily skewness_index_monthly], [kurtosis_index_daily
kurtosis_index_monthly],'VariableNames', {'Mean','Variance', 'Standard Deviation',
'Skewness', 'Kurtosis'},'RowNames', {'Daily, FTSE All Share', 'Monthly, FTSE All
Share'})
```

```
summary_statistics_index = 2x5 table
```

```
...
```

	Mean	Variance	Standard Deviation	Skewness
1 Daily, FTSE All Share	0.0004	0.0002	0.0138	-1.3311
2 Monthly, FTSE All Share	0.0088	0.0034	0.0581	-0.5508

10. Beta for selected security & Beta of portfolio

Daily

```
% Beta for each asset
for i = 1:12
```

```

cov_daily_i = cov(selected_returns_daily(:,i), index_returns_daily);
beta_daily(i)=cov_daily_i(1,2)/var_index_daily;
end
% Porfolio unconstrained
cov_daily_portfolio = cov(MV_weighted_returns_daily,index_returns_daily);
beta_portfolio_daily = cov_daily_portfolio(1,2)/var_index_daily;

% Portfolio constrained
cov_daily_portfolio_c = cov(MV_weighted_returns_daily_c,index_returns_daily);
beta_portfolio_daily_c = cov_daily_portfolio_c(1,2)/var_index_daily;

```

Monthly

```

% Beta for each asset
for i = 1:12
    cov_monthly_i = cov(selected_returns_monthly(:,i), index_returns_monthly);
    beta_monthly(i)=cov_monthly_i(1,2)/var_index_monthly;
end
% Porfolio unconstrained
cov_monthly_portfolio = cov(MV_weighted_returns_monthly,index_returns_monthly);
beta_portfolio_monthly = cov_monthly_portfolio(1,2)/var_index_monthly;

% Portfolio constrained
cov_monthly_portfolio_c = cov(MV_weighted_returns_monthly_c,index_returns_monthly);
beta_portfolio_monthly_c = cov_monthly_portfolio_c(1,2)/var_index_monthly;

```

Tables

```


|                           | Beta daily | Beta monthly |
|---------------------------|------------|--------------|
| 1 ECOSUNTEK               | 0.2979     | 0.8129       |
| 2 ALERIONCLEANPOWER       | 0.4297     | 0.5241       |
| 3 CENTRALEDELLATTEDITALIA | 0.3998     | 0.4759       |
| 4 ELEN                    | 0.7864     | 1.3205       |
| 5 AMPLIFON                | 0.6404     | 0.5806       |
| 6 FIDIA                   | 0.5812     | 0.9826       |
| 7 RISANAMENTO             | 0.7968     | 0.9044       |
| 8 BEEWIZE                 | 0.3541     | 0.3158       |
| 9 JUVENTUSFOOTBALLCLUB    | 0.7359     | 0.7272       |
| 10 VINCENZOZUCCHI         | 0.6113     | 0.7567       |
| 11 VIANINIINDR            | 0.1231     | 0.2022       |


```

```
%table with all the betas securities
```

```
betas_sec = table(beta_daily',beta_monthly','RowNames',namelist,'VariableNames',
```

```
{'Beta daily','Beta monthly'})
```

```
betas_sec = 12x2 table
```

	Beta daily	Beta monthly
1 ECOSUNTEK	0.2979	0.8129
2 ALERIONCLEANPOWER	0.4297	0.5241
3 CENTRALEDELLATTEDITALIA	0.3998	0.4759
4 ELEN	0.7864	1.3205
5 AMPLIFON	0.6404	0.5806
6 FIDIA	0.5812	0.9826
7 RISANAMENTO	0.7968	0.9044
8 BEEWIZE	0.3541	0.3158
9 JUVENTUSFOOTBALLCLUB	0.7359	0.7272
10 VINCENZOZUCCHI	0.6113	0.7567
11 VIANINIINDR	0.1231	0.2022

	Beta daily	Beta monthly
12 EDISONRSP	0.4488	0.3791

```
%table with all the betas portfolios
betas_port = table([beta_portfolio_daily beta_portfolio_daily_c]',
[beta_portfolio_monthly beta_portfolio_monthly_c]', 'RowNames', {'MV
unconstrained', 'MV constrained'}, 'VariableNames', {'Beta daily', 'Beta monthly'})
```

betas_port = 2x2 table

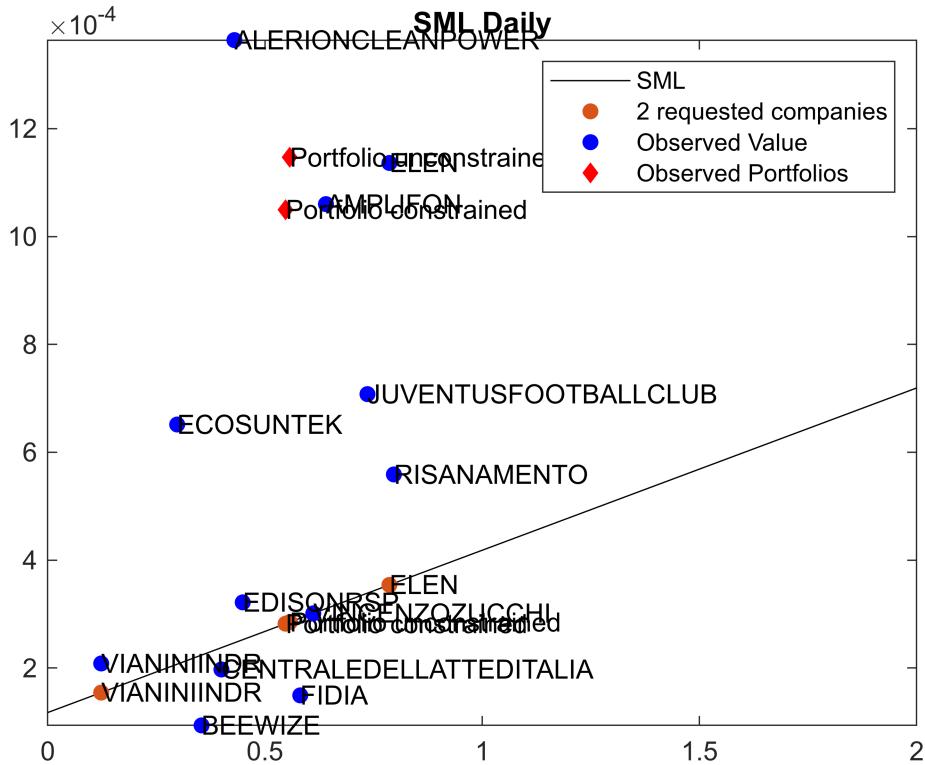
	Beta daily	Beta monthly
1 MV unconstrained	0.5572	0.5961
2 MV constrained	0.5474	0.6472

11. Security Market Line

```
r_f = 0.03;
r_f_daily = (1+r_f)^(1/252)-1; % 252 is the average of trading days in a year
r_f_monthly = (1+r_f)^(1/12)-1;
```

Daily

```
SML_daily_line = fplot(@(x) r_f_daily+(mean_index_daily-r_f_daily)*x,[0 2],"k");
hold on
SML_daily_assets = r_f_daily+(mean_index_daily-r_f_daily)*beta_daily;
SML_daily_portfolio = r_f_daily+(mean_index_daily-r_f_daily)*beta_portfolio_daily;
SML_daily_portfolio_c = r_f_daily+(mean_index_daily-
r_f_daily)*beta_portfolio_daily_c;
scatter([beta_daily([4 11]) beta_portfolio_daily beta_portfolio_daily_c],
[SML_daily_assets([4 11]) SML_daily_portfolio SML_daily_portfolio_c],"filled")
text([beta_daily([4 11]) beta_portfolio_daily beta_portfolio_daily_c],
[SML_daily_assets([4 11]) SML_daily_portfolio SML_daily_portfolio_c],[namelist([4
11]) "Portfolio unconstrained" "Portfolio constrained"])
scatter(beta_daily,port_MV_daily.AssetMean,"filled","blue")
text(beta_daily,port_MV_daily.AssetMean,namelist)
scatter([beta_portfolio_daily beta_portfolio_daily_c],[MV_mean_daily
MV_mean_daily_c],"filled","red","diamond")
text([beta_portfolio_daily beta_portfolio_daily_c],[MV_mean_daily MV_mean_daily_c],
["Portfolio unconstrained" "Portfolio constrained"])
title("SML Daily")
legend ('SML','2 requested companies','Observed Value','Observed Portfolios')
hold off
```

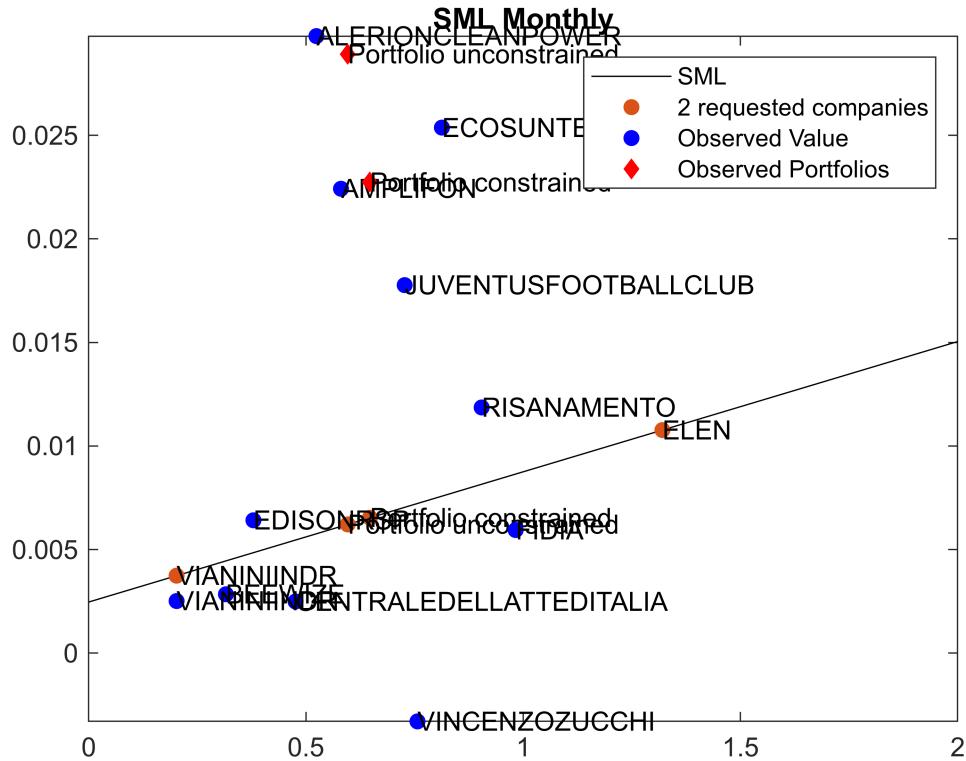


Monthly

```

SML_monthly_line = fplot(@(x) r_f_monthly+(mean_index_monthly-r_f_monthly)*x,[0
2],"k");
hold on
SML_monthly_assets = r_f_monthly+(mean_index_monthly-r_f_monthly)*beta_monthly;
SML_monthly_portfolio = r_f_monthly+(mean_index_monthly-
r_f_monthly)*beta_portfolio_monthly;
SML_monthly_portfolio_c = r_f_monthly+(mean_index_monthly-
r_f_monthly)*beta_portfolio_monthly_c;
scatter([beta_monthly([4 11]) beta_portfolio_monthly beta_portfolio_monthly_c],
[SML_monthly_assets([4 11]) SML_monthly_portfolio SML_monthly_portfolio_c],"filled")
text([beta_monthly([4 11]) beta_portfolio_monthly beta_portfolio_monthly_c],
[SML_monthly_assets([4 11]) SML_monthly_portfolio SML_monthly_portfolio_c],
[namelist([4 11]) "Portfolio unconstrained" "Portfolio constrained"])
scatter(beta_monthly,port_MV_monthly.AssetMean,"filled","blue")
text(beta_monthly,port_MV_monthly.AssetMean,namelist)
scatter([beta_portfolio_monthly beta_portfolio_monthly_c],[MV_mean_monthly
MV_mean_monthly_c],"filled","red","diamond")
text([beta_portfolio_monthly beta_portfolio_monthly_c],[MV_mean_monthly
MV_mean_monthly_c],["Portfolio unconstrained" "Portfolio constrained"])
title("SML Monthly")
legend ('SML','2 requested companies','Observed Value','Observed Portfolios')
hold off

```



12. Black-Litterman portfolio

Annual views

```

numAssets = 12;
v = 5; % total 5 views
P = zeros(v, numAssets);
q = zeros(v, 1);
tau = 1/numAssets;
mrkt_cap = [36.668 1590 38.36 883.16 6910 9370 176.302 7.16 915.453 61.903 40.365
6651];
w_mrkt = mrkt_cap./sum(mrkt_cap)

```

```

w_mrkt = 1x12
    0.0014    0.0596    0.0014    0.0331    0.2590    0.3512    0.0066    0.0003 ...

```

```
% ABSOLUTE View 1
```

```
P(1, namelist == "ALERIONCLEANPOWER") = 1;
q(1) = 0.35; %da modificare
```

```
% ABSOLUTE View 2
```

```
P(2, namelist == "ECOSUNTEK") = 1;
q(2) = 0.30; %da modificare
```

```
% ABSOLUTE View 3
```

```
P(3, namelist == "BEEWIZE") = 1;
```

```

q(3) = 0.08; %da modificare

% RELATIVE View 4
P(4, namelist == "ALERIONCLEANPOWER") = 1; % more green sustainable
P(4, namelist == "EDISONRSP") = -1;
q(4) = 0.15; %da modificare

% RELATIVE View 5
P(5, namelist == "BEEWIZE") = 1; % BEEWIZE technological pumps w.r.t. manufactorial
FIDIA stallo
P(5, namelist == "VIANINIINDR") = -1;
q(5) = 0.02; %da modificare

```

Daily constrained

```

q_daily = 1/252.*q;
Sigma_daily = port_MV_daily.AssetCovar;
Omega_daily = diag(diag(P*(tau.*Sigma_daily)*P'));
C_daily = tau.*Sigma_daily;

% Find Prior PI
w_mrkt;
delta_daily = (mean_index_daily)/var_index_daily; % Risk Aversion Coefficient
PI_daily = delta_daily*Sigma_daily*w_mrkt';

% Expected returns e std with the views
mu_bl_daily = (P'*(Omega_daily\P) + inv(C_daily)) \ ( C_daily\PI_daily +
P'*(Omega_daily\q_daily));
cov_mu_daily = inv(P'*(Omega_daily\P) + inv(C_daily));

%Black-Littermann portfolio
port_BL_daily = Portfolio('NumAssets', numAssets, 'LowerBudget', 1, 'UpperBudget', 1);
port_BL_daily = setDefaultConstraints(port_BL_daily);
port_BL_daily = setAssetMoments(port_BL_daily, mu_bl_daily, Sigma_daily +
cov_mu_daily);
BL_daily_std = (sqrt(diag(port_BL_daily.AssetCovar)));

BL_weight_sharpe_daily = estimateMaxSharpeRatio(port_BL_daily); % We compute the MV
optimal weights that maximise the Sharpe Ratio
[wBLd_sigma_sharpe, wBLd_returns_sharpe] = estimatePortMoments(port_BL_daily,
BL_weight_sharpe_daily);

% pie plot

ax1_daily = subplot(1,2,1);
idx_MV_d = MV_weight_sharpe_daily_c>0.001;
pie(ax1_daily, MV_weight_sharpe_daily_c(idx_MV_d), namelist(idx_MV_d));
title(ax1_daily, port_MV_daily_c.Name , 'Position', [-0.05, 1.6, 0]);

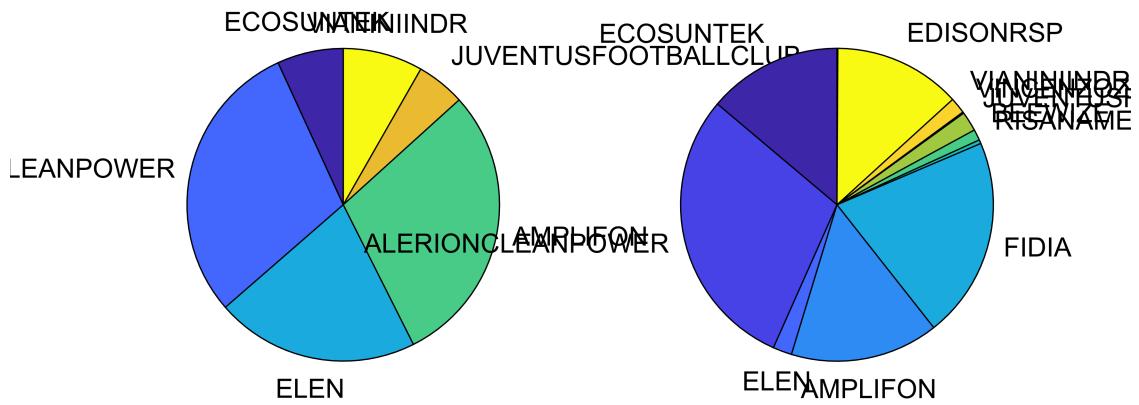
ax2_daily = subplot(1,2,2);

```

```

idx_BL_d = BL_weight_sharpe_daily>0.001;
pie(ax2_daily, BL_weight_sharpe_daily(idx_BL_d), namelist(idx_BL_d));
title(ax2_daily, port_BL_daily.Name ,'Position', [-0.05, 1.6, 0]);

```



```

%table
table(namelist', MV_weight_sharpe_daily_c, BL_weight_sharpe_daily, 'VariableNames',
["AssetName", ...
 "Weights MV constrain ", "Weights Black_Litterman"])

```

	AssetName	Weights MV constrain	Weights Black_Litterman
1	"ECOSUNTEK"	0.0685	0.1386
2	"ALERIONCLEANPOWER"	0.2954	0.2948
3	"CENTRALEDELLATTEDI..."	0	0.0009
4	"ELEN"	0.2102	0.0196
5	"AMPLIFON"	0.2929	0.1533
6	"FIDIA"	0	0.2079
7	"RISANAMENTO"	0	0.0039
8	"BEEWIZE"	0	0.0113
9	"JUVENTUSFOOTBALLCLUB"	0.0503	0.0203
10	"VINCENZOZUCCHI"	0	0.0014

	AssetName	Weights MV constrain	Weights Black_Litterman
11	"VIANINIINDR"	0.0826	0.0165
12	"EDISONRSP"	0	0.1316

Monthly constrained

```

q_monthly = 1/12.*q;
Sigma_monthly = port_MV_monthly.AssetCovar;
Omega_monthly = diag(diag(P*(tau.*Sigma_monthly)*P'));
C_monthly = tau.*Sigma_monthly;

% Find Prior PI
w_mrkt;
delta_monthly = (mean_index_monthly)/var_index_monthly; % Risk Aversion Coefficient
PI_monthly = delta_monthly*Sigma_monthly*w_mrkt';

% Expected returns e std with the views
mu_bl_monthly = (P'*(Omega_monthly\P) + inv(C_monthly)) \ ( C_monthly\PI_monthly +
P'*(Omega_monthly\q_monthly));
cov_mu_monthly = inv(P'*(Omega_monthly\P) + inv(C_monthly));

%Black-Littermann portfolio
port_BL_monthly = Portfolio('NumAssets', numAssets, 'LowerBudget',
1, 'UpperBudget',1);
port_BL_monthly = setDefaultConstraints(port_BL_monthly);
port_BL_monthly = setAssetMoments(port_BL_monthly, mu_bl_monthly, Sigma_monthly +
cov_mu_monthly);
BL_monthly_std = (sqrt(diag(port_BL_monthly.AssetCovar)));

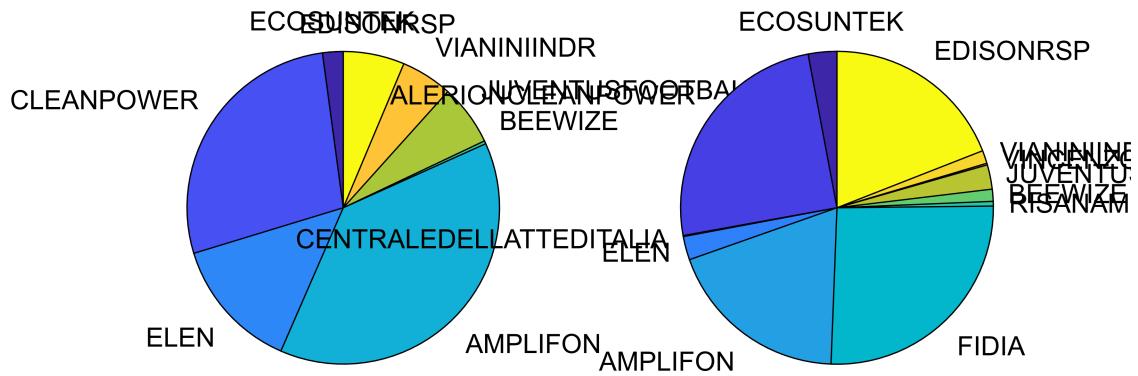
BL_weight_sharpe_monthly = estimateMaxSharpeRatio(port_BL_monthly); % We compute
the MV optimal weights that maximise the Sharpe Ratio
[wBLm_sigma_sharpe , wBLm_returns_sharpe] = estimatePortMoments(port_BL_monthly,
BL_weight_sharpe_monthly);

% pie plot

ax1_monthly = subplot(1,2,1);
idx_MV_m = MV_weight_sharpe_monthly_c > 0.001;
pie(ax1_monthly, MV_weight_sharpe_monthly_c(idx_MV_m), namelist(idx_MV_m));
title(ax1_monthly, port_MV_monthly_c.Name , 'Position', [-0.05, 1.6, 0]);

ax2_monthly = subplot(1,2,2);
idx_BL_m = BL_weight_sharpe_monthly>0.001;
pie(ax2_monthly, BL_weight_sharpe_monthly(idx_BL_m), namelist(idx_BL_m));
title(ax2_monthly, port_BL_monthly.Name , 'Position', [-0.05, 1.6, 0]);

```



```
%table
table(namelist', MV_weight_sharpe_monthly_c, BL_weight_sharpe_monthly,
'VariableNames', ["AssetName", ...
"Weights MV constrain ", "Weights Black_Litterman"])
```

	AssetName	Weights MV constrain	Weights Black_Litterman
1	"ECOSUNTEK"	0.0213	0.0296
2	"ALERIONCLEANPOWER"	0.2758	0.2489
3	"CENTRALEDELLATTEDI..."	0	0.0011
4	"ELEN"	0.1375	0.0243
5	"AMPLIFON"	0.3826	0.1901
6	"FIDIA"	0	0.2578
7	"RISANAMENTO"	0	0.0049
8	"BEEWIZE"	0.0031	0.0125
9	"JUVENTUSFOOTBALLCLUB"	0.0630	0.0252
10	"VINCENZOZUCCHI"	0	0.0017
11	"VIANINIINDR"	0.0532	0.0134
12	"EDISONRSP"	0.0634	0.1906

13. Standard Bayesian Asset Allocation

Daily constrained

```
mu_prior_daily = port_MV_daily_c.AssetMean+1*(sqrt(diag(Sigma_daily))); % mean of prior (Gm)
Lambda_daily = 2*Sigma_daily; % cov of prior
T = 12;

mu_Bayes_daily = (inv(T*inv(Sigma_daily))
+inv(Lambda_daily)))*(T*inv(Sigma_daily))*mean(selected_returns_daily)' +
Lambda_daily\mu_prior_daily; %mean of bayesian model
Sigma1_daily = inv(T*inv(Sigma_daily)+inv(Lambda_daily)); % Standard deviation of bayesian model

% standard Bayesian model
port_Bayes_daily = Portfolio('AssetList', namelist, 'NumAssets', 12, 'LowerBudget',
1, 'UpperBudget',1);
port_Bayes_daily.AssetMean = mu_Bayes_daily;
port_Bayes_daily.AssetCovar = Sigma1_daily;
port_Bayes_daily = setBounds(port_Bayes_daily, 0, 1);
Bayes_weight_sharpe_daily = port_Bayes_daily.estimateMaxSharpeRatio;
[wBayes_d_sigma_sharpe , wBayes_d_returns_sharpe] =
estimatePortMoments(port_Bayes_daily,Bayes_weight_sharpe_daily);

% Pie plot

ax3 = subplot(1,2,1);
idx = BL_weight_sharpe_daily > 0.001;
pie(ax3,BL_weight_sharpe_daily(idx))
legend(namelist(idx), 'Location', 'southwest')
title(ax3,'Black-Litterman', 'FontSize',15);

ax4 = subplot(1,2,2);
idx = Bayes_weight_sharpe_daily > 0.001;
pie(ax4,Bayes_weight_sharpe_daily(idx))
legend(namelist(idx) , 'Location' , 'southwest')
title(ax4,'Bayesian approach', 'FontSize', 15);
```

Monthly constrained

```
mu_prior_monthly = port_MV_monthly_c.AssetMean+1*(sqrt(diag(Sigma_monthly))); % mean of prior (Gm)
Lambda_monthly = 2*Sigma_monthly; % cov of prior
T = 12;

mu_Bayes_monthly = (inv(T*inv(Sigma_monthly))
+inv(Lambda_monthly)))*(T*inv(Sigma_monthly))*mean(selected_returns_monthly)' +
Lambda_monthly\mu_prior_monthly); %mean of bayesian model
```

```

Sigma1_monthly = inv(T*inv(Sigma_monthly)+inv(Lambda_monthly)); % Standard
deviation of bayesian model

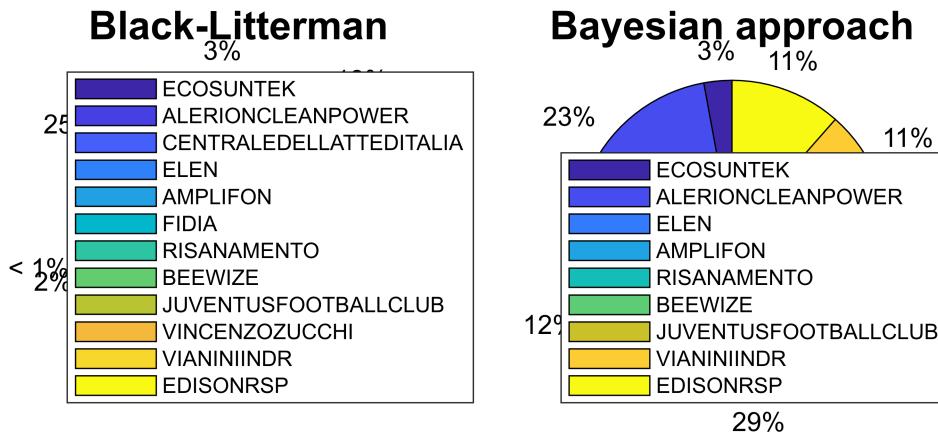
% standard Bayesian model
port_Bayes_monthly = Portfolio('AssetList', namelist, 'NumAssets',
12, 'LowerBudget', 1, 'UpperBudget',1);
port_Bayes_monthly.AssetMean = mu_Bayes_monthly;
port_Bayes_monthly.AssetCovar = Sigma1_monthly;
port_Bayes_monthly = setBounds(port_Bayes_monthly, 0, 1);
Bayes_weight_sharpe_monthly = port_Bayes_monthly.estimateMaxSharpeRatio;
[wBayes_m_sigma_sharpe , wBayes_m_returns_sharpe] =
estimatePortMoments(port_Bayes_monthly,Bayes_weight_sharpe_monthly);

% Pie plot

ax5 = subplot(1,2,1);
idx = BL_weight_sharpe_monthly > 0.001;
pie(ax5,BL_weight_sharpe_monthly(idx))
legend(namelist(idx), 'Location' , 'southwest')
title(ax5,'Black-Litterman', 'FontSize',15);

ax6 = subplot(1,2,2);
idx = Bayes_weight_sharpe_monthly > 0.001;
pie(ax6,Bayes_weight_sharpe_monthly(idx))
legend(namelist(idx) , 'Location' , 'southwest')
title(ax6,'Bayesian approach', 'FontSize', 15);

```



14. Global Minimum Portfolio Variance

Daily, constrained

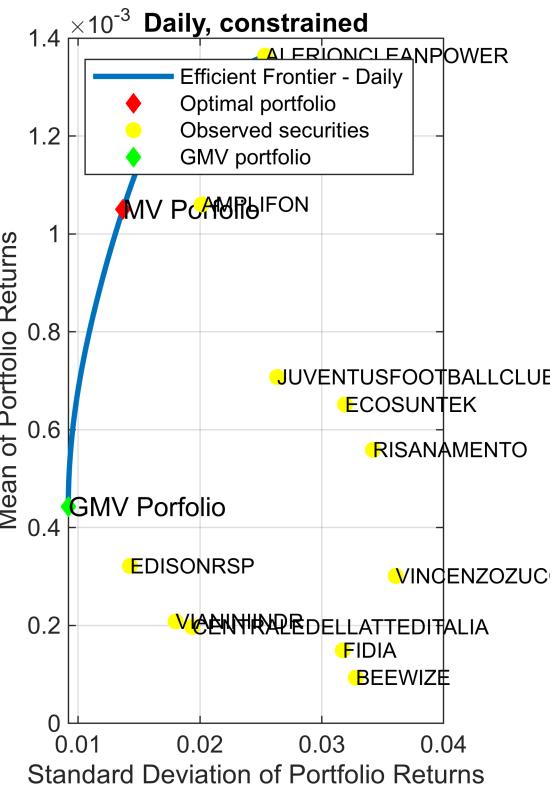
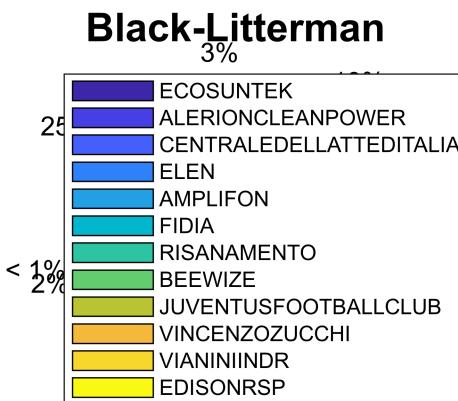
```
% GMV Portfolio
port_GMV_daily = Portfolio('AssetList', namelist, 'NumAssets', numAssets);
port_GMV_daily= port_GMV_daily.estimateAssetMoments(selected_returns_daily);
port_GMV_daily = setDefaultConstraints(port_GMV_daily);
% weights for minimum variance portfolio
GMV_weight_daily = port_GMV_daily.estimateFrontierLimits('min');
GMV_weighted_returns_daily = selected_returns_daily*GMV_weight_daily;
GMV_mean_daily = mean(GMV_weighted_returns_daily);
GMV_std_daily = std(GMV_weighted_returns_daily);

eff_frontier_daily_c = plotFrontier(port_MV_daily_c,50)
```

```
eff_frontier_daily_c = 50x1
```

```
0.0092
0.0092
0.0092
0.0092
0.0093
0.0093
0.0094
0.0094
0.0095
0.0096
:
```

```
hold on
scatter(MV_std_daily_c,MV_mean_daily_c,"filled","diamond","red")
text(MV_std_daily_c,MV_mean_daily_c,"MV Porfolio")
scatter(sqrt(diag(port_MV_daily_c.AssetCovar)),port_MV_daily_c.AssetMean,"filled","yellow")
text(sqrt(diag(port_MV_daily_c.AssetCovar)),port_MV_daily_c.AssetMean,namelist,"FontSize",8)
scatter(GMV_std_daily,GMV_mean_daily,"filled","diamond","green")
text(GMV_std_daily,GMV_mean_daily,"GMV Porfolio")
title("Daily, constrained")
legend('Efficient Frontier - Daily','Optimal portfolio','Observed securities','GMV portfolio','Location','northwest')
hold off
```



Monthly, constrained

```
% GMV Portfolio
port_GMV_monthly = Portfolio('AssetList', namelist, 'NumAssets', numAssets);
port_GMV_monthly= port_GMV_monthly.estimateAssetMoments(selected_returns_monthly);
port_GMV_monthly = setDefaultConstraints(port_GMV_monthly);
% weights for minimum variance portfolio
GMV_weight_monthly = port_GMV_monthly.estimateFrontierLimits('min');
GMV_weighted_returns_monthly = selected_returns_monthly*GMV_weight_monthly;
GMV_mean_monthly = mean(GMV_weighted_returns_monthly);
GMV_std_monthly = std(GMV_weighted_returns_monthly);

eff_frontier_monthly_c = plotFrontier(port_MV_monthly_c,50)
```

```
eff_frontier_monthly_c = 50x1
0.0355
0.0355
0.0357
0.0358
0.0361
0.0364
0.0368
0.0372
0.0377
0.0383
:
```

```
hold on
```

```

scatter(MV_std_monthly_c,MV_mean_monthly_c,"filled","diamond","red")
text(MV_std_monthly_c,MV_mean_monthly_c,"MV Porfolio")
scatter(sqrt(diag(port_MV_monthly_c.AssetCovar)),port_MV_monthly_c.AssetMean,"filled",
,"yellow")
text(sqrt(diag(port_MV_monthly_c.AssetCovar)),port_MV_monthly_c.AssetMean,namelist,
"FontSize",8)
scatter(GMV_std_monthly,GMV_mean_monthly,"filled","diamond","green")
text(GMV_std_monthly,GMV_mean_monthly,"GMV Porfolio")
title("Monthly, constrained")
legend('Efficient Frontier - Daily','Optimal portfolio','Observed securities','GMV
portfolio','Location','northwest')
hold off

```

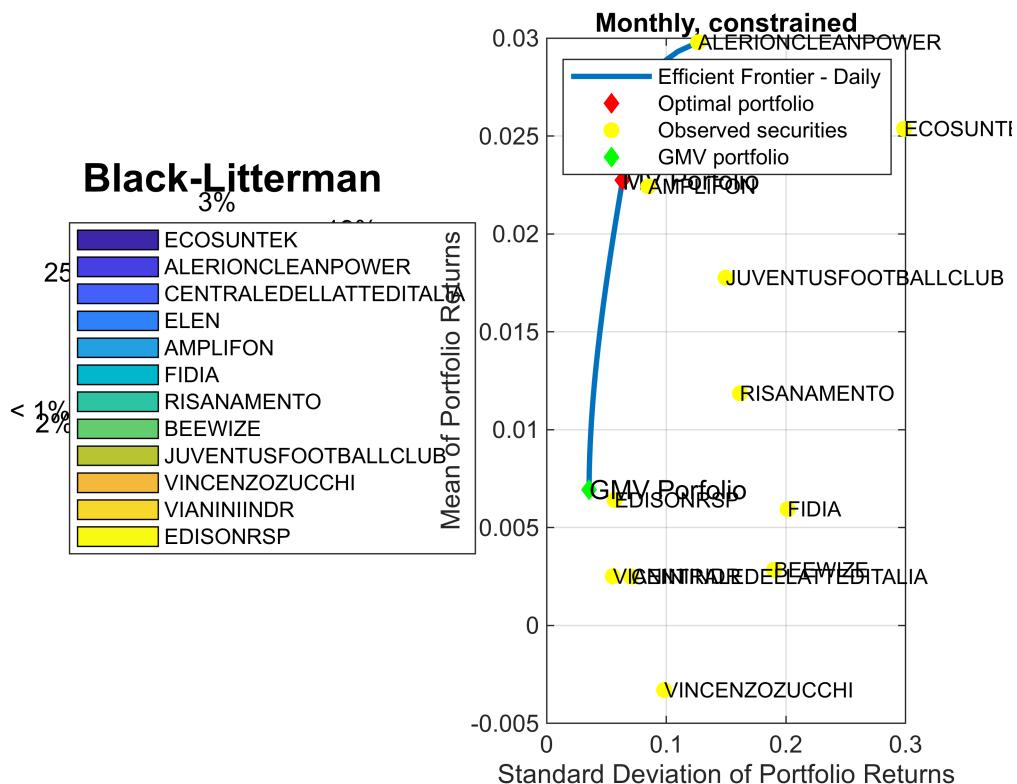


Table of Weights

```

table(namelist', GMV_weight_daily, GMV_weight_monthly, 'VariableNames', ["Asset
Name", ...
 "Weights GMV daily ", "Weights GMV monthly"])

```

ans = 12×3 table

	Asset Name	Weights GMV daily	Weights GMV monthly
1	"ECOSUNTEK"	0.0574	0
2	"ALERIONCLEANPOWER"	0.0566	0.0285
3	"CENTRALEDELLATTEDI..."	0.1274	0.1337
4	"ELEN"	0.0289	0

	Asset Name	Weights GMV daily	Weights GMV monthly
5	"AMPLIFON"	0.0863	0.0819
6	"FIDIA"	0.0258	0.0148
7	"RISANAMENTO"	0	0
8	"BEEWIZE"	0.0454	0.0270
9	"JUVENTUSFOOTBALLCLUB"	0.0356	0.0389
10	"VINCENZOZUCCHI"	0.0216	0
11	"VIANINIINDR"	0.2367	0.3267
12	"EDISONRSP"	0.2782	0.3485

Overall Statistics of all constrained portfolios

% BL statistics

```
BL_weighted_returns_daily = selected_returns_daily*BL_weight_sharpe_daily;
BL_mean_daily = mean(BL_weighted_returns_daily);
BL_std_daily = std(BL_weighted_returns_daily);
BL_var_daily = var(BL_weighted_returns_daily);
BL_skew_daily = skewness(BL_weighted_returns_daily);
BL_kurt_daily = kurtosis(BL_weighted_returns_daily);
BL_Sharpe_daily = sharpe(BL_weighted_returns_daily);
```

Warning: No Cash return specified. Will assume return is 0.

```
BL_weighted_returns_monthly = selected_returns_monthly*BL_weight_sharpe_monthly;
BL_mean_monthly = mean(BL_weighted_returns_monthly);
BL_std_monthly = std(BL_weighted_returns_monthly);
BL_var_monthly = var(BL_weighted_returns_monthly);
BL_skew_monthly = skewness(BL_weighted_returns_monthly);
BL_kurt_monthly = kurtosis(BL_weighted_returns_monthly);
BL_Sharpe_monthly = sharpe(BL_weighted_returns_monthly);
```

Warning: No Cash return specified. Will assume return is 0.

% Bayesian statistics

```
Bayes_weighted_returns_daily = selected_returns_daily*Bayes_weight_sharpe_daily;
Bayes_mean_daily = mean(Bayes_weighted_returns_daily);
Bayes_std_daily = std(Bayes_weighted_returns_daily);
Bayes_var_daily = var(Bayes_weighted_returns_daily);
Bayes_skew_daily = skewness(Bayes_weighted_returns_daily);
Bayes_kurt_daily = kurtosis(Bayes_weighted_returns_daily);
Bayes_Sharpe_daily = sharpe(Bayes_weighted_returns_daily);
```

Warning: No Cash return specified. Will assume return is 0.

```

Bayes_weighted_returns_monthly =
selected_returns_monthly*Bayes_weight_sharpe_monthly;
Bayes_mean_monthly = mean(Bayes_weighted_returns_monthly);
Bayes_std_monthly = std(Bayes_weighted_returns_monthly);
Bayes_var_monthly = var(Bayes_weighted_returns_monthly);
Bayes_skew_monthly = skewness(Bayes_weighted_returns_monthly);
Bayes_kurt_monthly = kurtosis(Bayes_weighted_returns_monthly);
Bayes_Sharpe_monthly = sharpe(Bayes_weighted_returns_monthly);

```

Warning: No Cash return specified. Will assume return is 0.

```

% GMV statistics
% - First section above
GMV_var_daily = var(GMV_weighted_returns_daily);
GMV_skew_daily = skewness(GMV_weighted_returns_daily);
GMV_kurt_daily = kurtosis(GMV_weighted_returns_daily);
GMV_Sharpe_daily = sharpe(GMV_weighted_returns_daily);

```

Warning: No Cash return specified. Will assume return is 0.

```

% - Second section above
GMV_var_monthly = var(GMV_weighted_returns_monthly);
GMV_skew_monthly = skewness(GMV_weighted_returns_monthly);
GMV_kurt_monthly = kurtosis(GMV_weighted_returns_monthly);
GMV_Sharpe_monthly = sharpe(GMV_weighted_returns_monthly);

```

Warning: No Cash return specified. Will assume return is 0.

```

summary_table_portfolios_statistics_c = table( ...
    [MV_mean_daily_c MV_mean_monthly_c BL_mean_daily BL_mean_monthly
    Bayes_mean_daily Bayes_mean_monthly GMV_mean_daily GMV_mean_monthly]', ...
    [MV_std_daily_c MV_std_monthly_c BL_std_daily BL_std_monthly Bayes_std_daily
    Bayes_std_monthly GMV_std_daily GMV_std_monthly]', ...
    [MV_var_daily_c MV_var_monthly_c BL_var_daily BL_var_monthly Bayes_var_daily
    Bayes_var_monthly GMV_var_daily GMV_var_monthly]', ...
    [MV_skew_daily_c MV_skew_monthly_c BL_skew_daily BL_skew_monthly
    Bayes_skew_daily Bayes_skew_monthly GMV_skew_daily GMV_skew_monthly]', ...
    [MV_kurt_daily_c MV_kurt_monthly_c BL_kurt_daily BL_kurt_monthly
    Bayes_kurt_daily Bayes_kurt_monthly GMV_kurt_daily GMV_kurt_monthly]', ...
    [MV_Sharpe_daily_c MV_Sharpe_monthly_c BL_Sharpe_daily BL_Sharpe_monthly
    Bayes_Sharpe_daily Bayes_Sharpe_monthly GMV_Sharpe_daily GMV_Sharpe_monthly]', ...
    'RowNames',[ "Mean-Variance Daily" "Mean-Variance Monthly" "Black-Litterman
    Daily" "Black-Litterman Monthly" ...
    "Bayesian Daily" "Bayesian Monthly" "GMV Daily" "GMV Monthly"],'VariableNames',
    ...
    ["Mean" "Standard deviation" "Variance" "Skewness" "Kurtosis" "Sharpe Ratio"])

```

summary_table_portfolios_statistics_c = 8x6 table

...

	Mean	Standard deviation	Variance	Skewness
1 Mean-Variance Daily	0.0010	0.0137	0.0002	-0.2901
2 Mean-Variance Monthly	0.0227	0.0634	0.0040	-0.0670
3 Black-Litterman Daily	0.0008	0.0136	0.0002	0.1317
4 Black-Litterman Monthly	0.0164	0.0747	0.0056	2.2776
5 Bayesian Daily	0.0004	0.0098	0.0001	-0.4237
6 Bayesian Monthly	0.0199	0.0561	0.0031	-0.1238
7 GMV Daily	0.0004	0.0092	0.0001	-0.8037
8 GMV Monthly	0.0069	0.0355	0.0013	-0.0561

15. Linear combination of the 4 Portfolios

Combined portfolio

```
% Daily constrained
combined_portfolio_weighted_returns_daily =
0.25.*(MV_weighted_returns_daily_c+BL_weighted_returns_daily+Bayes_weighted_returns_
daily+GMV_weighted_returns_daily);
combined_mean_daily = mean(combined_portfolio_weighted_returns_daily);
combined_std_daily = std(combined_portfolio_weighted_returns_daily);
combined_var_daily = var(combined_portfolio_weighted_returns_daily);
combined_skew_daily = skewness(combined_portfolio_weighted_returns_daily);
combined_kurt_daily = kurtosis(combined_portfolio_weighted_returns_daily);
combined_Sharpe_daily = sharpe(combined_portfolio_weighted_returns_daily);
```

Warning: No Cash return specified. Will assume return is 0.

```
combined_weight_daily = 0.25.*(MV_weight_sharpe_daily_c + BL_weight_sharpe_daily +
Bayes_weight_sharpe_daily + GMV_weight_daily);
```

```
% Monthly constrained
combined_portfolio_weighted_returns_monthly =
0.25.*(MV_weighted_returns_monthly_c+BL_weighted_returns_monthly+Bayes_weighted_returns_
monthly+GMV_weighted_returns_monthly);
combined_mean_monthly = mean(combined_portfolio_weighted_returns_monthly);
combined_std_monthly = std(combined_portfolio_weighted_returns_monthly);
combined_var_monthly = var(combined_portfolio_weighted_returns_monthly);
combined_skew_monthly = skewness(combined_portfolio_weighted_returns_monthly);
combined_kurt_monthly = kurtosis(combined_portfolio_weighted_returns_monthly);
combined_Sharpe_monthly = sharpe(combined_portfolio_weighted_returns_monthly);
```

Warning: No Cash return specified. Will assume return is 0.

```
combined_weight_monthly = 0.25.* (MV_weight_sharpe_monthly_c +
BL_weight_sharpe_monthly + Bayes_weight_sharpe_monthly + GMV_weight_monthly);
```

Tables

```
table(namelist', combined_weight_daily, combined_weight_monthly, 'VariableNames',
["Asset Name", ...
 "Weights Combined daily ", "Weights Combined monthly"])
```

ans = 12x3 table

	Asset Name	Weights Combined daily	Weights Combined monthly
1	"ECOSUNTEK"	0.0791	0.0200
2	"ALERIONCLEANPOWER"	0.1757	0.1964
3	"CENTRALEDELLATTEDI..."	0.0522	0.0337
4	"ELEN"	0.0691	0.0696
5	"AMPLIFON"	0.1380	0.2370
6	"FIDIA"	0.0672	0.0681
7	"RISANAMENTO"	0.0075	0.0022
8	"BEEWIZE"	0.0223	0.0171
9	"JUVENTUSFOOTBALLCLUB"	0.0308	0.0510
10	"VINCENZOZUCCHI"	0.0083	0.0004
11	"VIANINIINDR"	0.1821	0.1252
12	"EDISONRSP"	0.1676	0.1794

```
summary_table_combined_portfolio_statistics = table([combined_mean_daily
combined_mean_monthly]', [combined_std_daily combined_std_monthly]', ...
[combined_var_daily combined_var_monthly]', [combined_skew_daily
combined_skew_monthly]', [combined_kurt_daily combined_kurt_monthly]', ...
[combined_Sharpe_daily combined_Sharpe_monthly]', ...
'VariableNames',[ "Mean" "Standard deviation" "Variance" "Skewness" "Kurtosis"
"Sharpe Ratio"], ...
'RowNames',[ "Daily combined portfolio" "Monthly combined porfolio"])
```

summary_table_combined_portfolio_statistics = 2x6 table

	Mean	Standard deviation	Variance	Skewness
1 Daily combined portfolio	0.0007	0.0101	0.0001	-0.6776
2 Monthly combined porfolio	0.0165	0.0513	0.0026	0.1362