

SPY Data Analysis

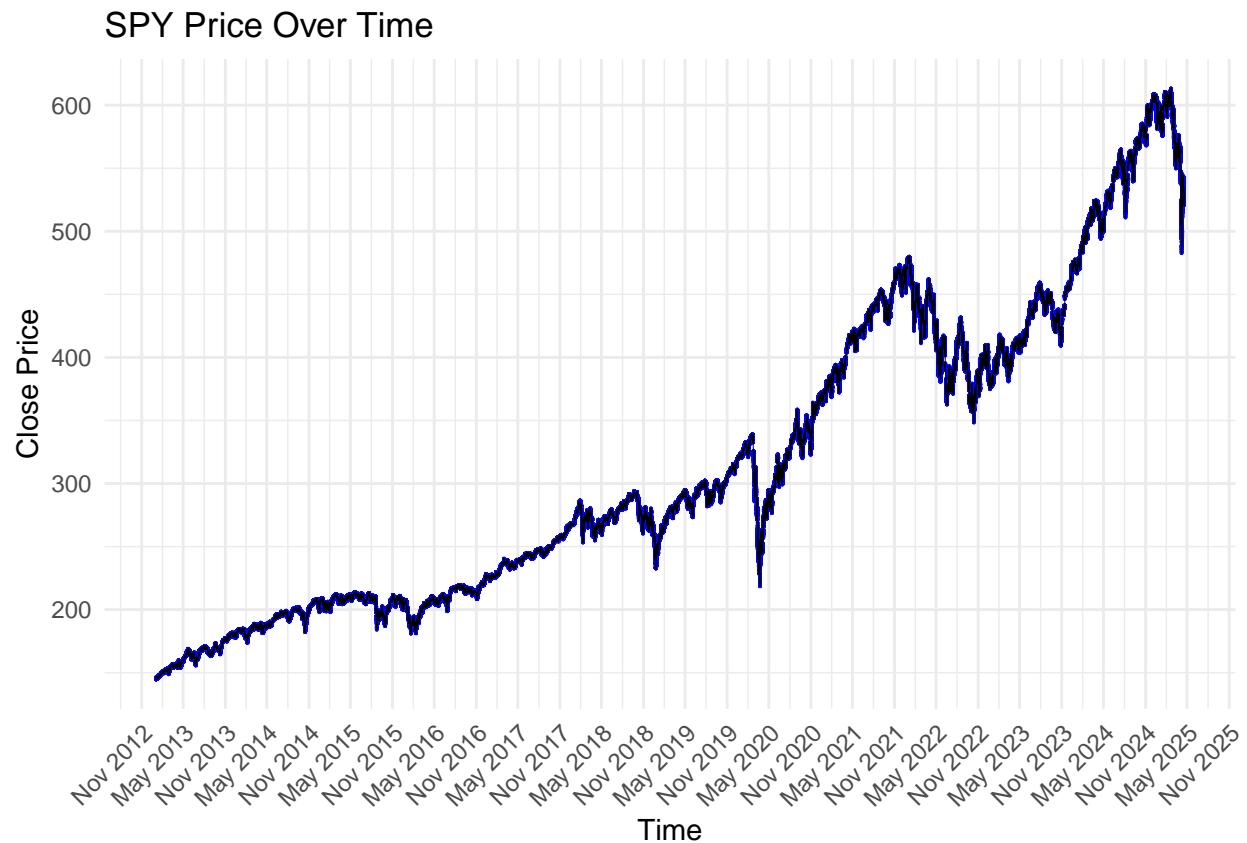
Contents

Price	2
Plots	2
Time Series Analysis	5
Realised Volatility	9
Computations	9
Plots	10

Price

Plots

```
#All Time  
price_plotter(raw_SPY, "SPY Price Over Time")
```



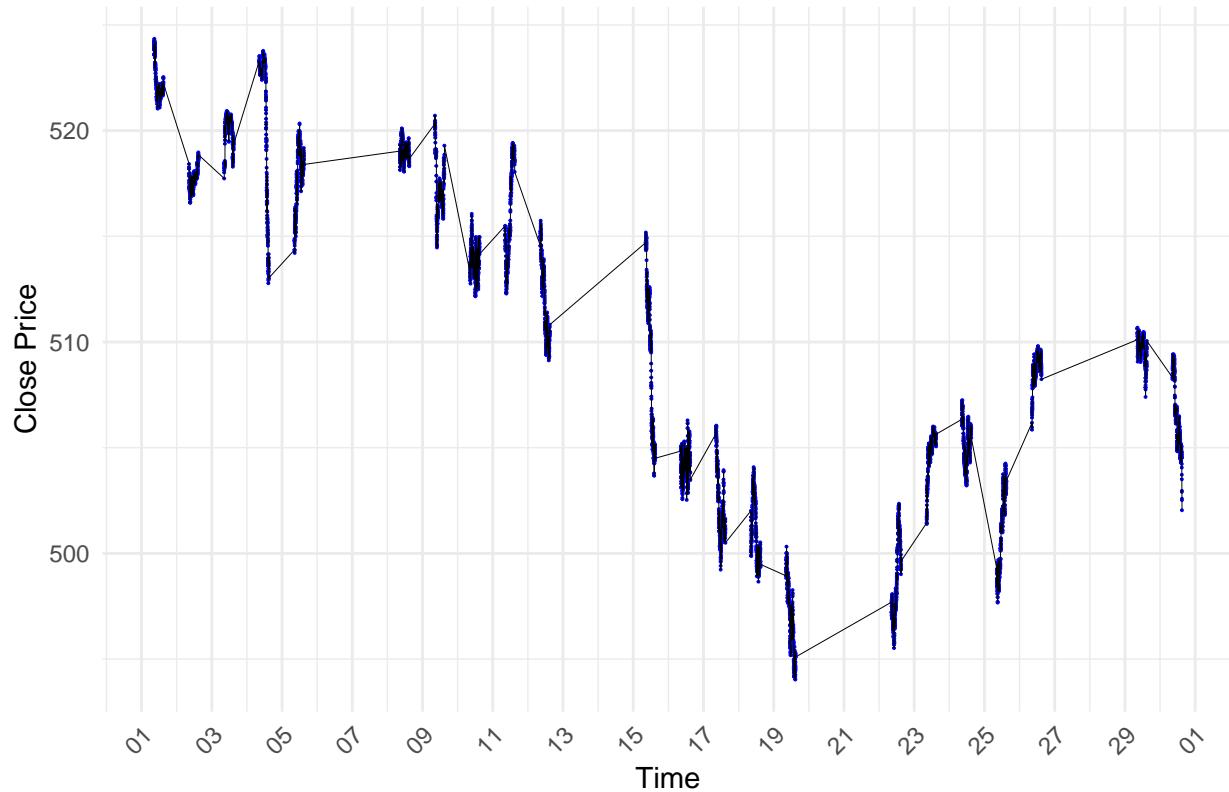
```
#2024  
SPY_2024 = year_selector(raw_SPY, 2024)  
price_plotter_year(SPY_2024, "SPY Price - 2024")
```

SPY Price – 2024



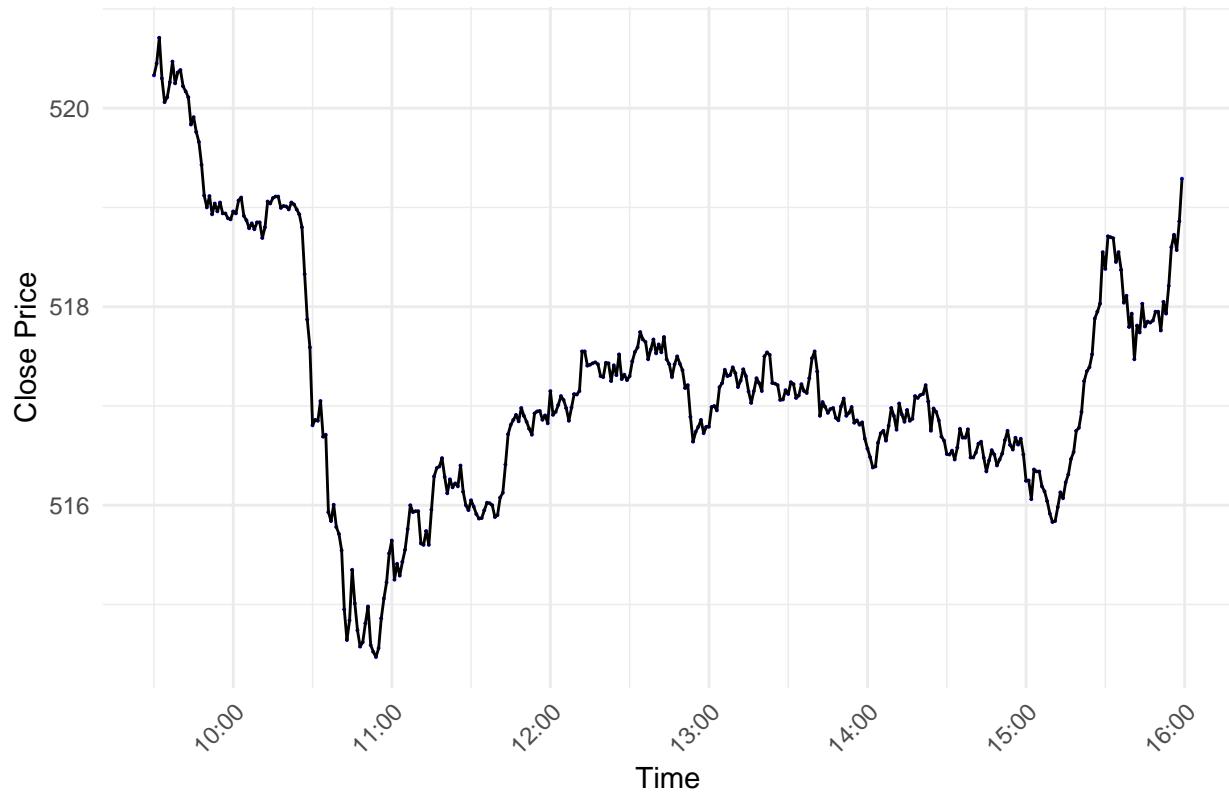
```
#April 2025
SPY_2025_04 = month_selector(raw_SPY, 2024, 04)
price_plotter_month(SPY_2025_04, "SPY Price - April 2025")
```

SPY Price – April 2025



```
#9th of April 2025
SPY_2025_04_09 = day_selector(raw_SPY,2024,04,09)
price_plotter_day(SPY_2025_04_09,"SPY Price - 9th of April 2025")
```

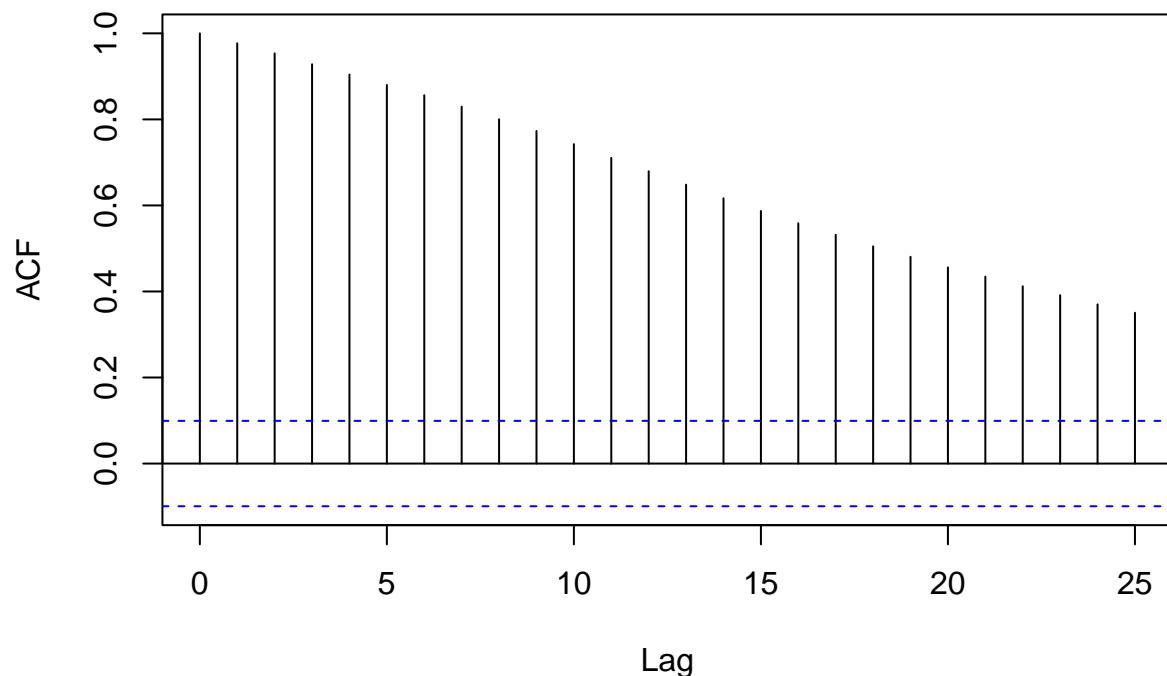
SPY Price – 9th of April 2025



Time Series Analysis

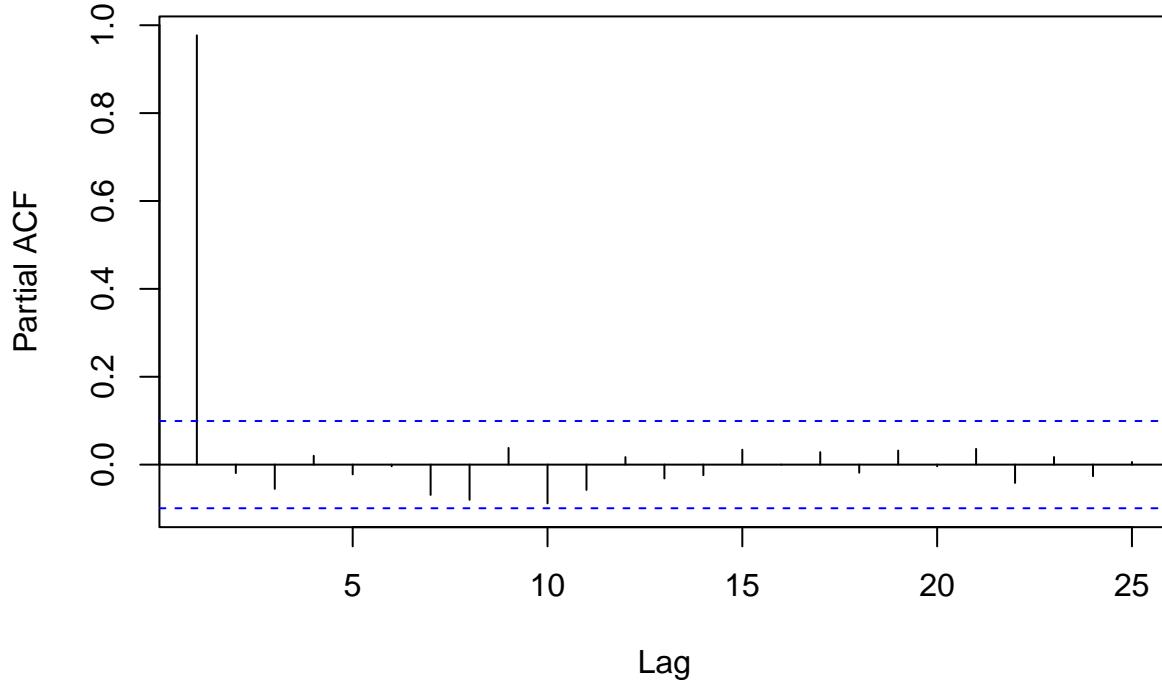
```
acf(SPY_2025_04_09$close)
```

Series SPY_2025_04_09\$close



```
pacf(SPY_2025_04_09$close)
```

Series SPY_2025_04_09\$close



```
AR1 = arima(SPY_2025_04_09$close, c(1,0,0), method="ML")
AR2 = arima(SPY_2025_04_09$close, c(2,0,0), method="ML")
AR3 = arima(SPY_2025_04_09$close, c(3,0,0), method="CSS")
table1 = export_summs(AR1,AR2,AR3, model.names = c("AR1","AR2","AR3"), digits = 4)
```

```
## Warning in FUN(X[[i]], ...): tidy() does not return p values for models of
## class data.frame; significance stars not printed.
## Warning in FUN(X[[i]], ...): tidy() does not return p values for models of
## class data.frame; significance stars not printed.
## Warning in FUN(X[[i]], ...): tidy() does not return p values for models of
## class data.frame; significance stars not printed.
```

```
huxtable::caption(table1) <- "AR Estimations"
huxtable::set_width(table1, 0.8)
```

```
AR1res = as.numeric(AR1$residuals)
AR1res_lagged <- lag(AR1res, 1)
iidcheck1 = lm(AR1res ~ AR1res_lagged)
AR2res = as.numeric(AR2$residuals)
AR2res_lagged <- lag(AR2res, 1)
iidcheck2 = lm(AR2res ~ AR2res_lagged)
AR3res = as.numeric(AR3$residuals)
AR3res_lagged <- lag(AR3res, 1)
iidcheck3 = lm(AR3res ~ AR3res_lagged)
```

Table 1: AR Estimations

	AR1	AR2	AR3
ar1	0.9944 (0.0047)	1.0598 (0.0509)	1.0399 (0.0507)
intercept	518.3317 (1.1978)	518.2751 (1.1607)	517.0057 (0.4637)
ar2		-0.0659 (0.0511)	0.0210 (0.0731)
ar3			-0.0796 (0.0505)
nobs	390	390	390
sigma	0.1723	0.1719	0.1701
logLik	130.2386	131.0665	
AIC	-254.4771	-254.1331	
BIC	-242.5787	-238.2685	
nobs.1	390.0000	390.0000	390.0000

*** p < 0.001; ** p < 0.01; * p < 0.05.

```
table2 = export_summs(iidcheck1,iidcheck2,iidcheck3,
                      model.names = c("AR1 Residuals","AR2 Residuals","AR3 Residuals"),
                      digits = 4)
huxtable::caption(table2) <- "Checking Residuals"
huxtable::set_width(table2, 0.8)
```

Table 2: Checking Residuals

	AR1 Residuals	AR2 Residuals	AR3 Residuals
(Intercept)	-0.0085 (0.0087)	-0.0091 (0.0087)	0.0000 (0.0086)
AR1res_lagged	0.0634 (0.0511)		
AR2res_lagged		-0.0074 (0.0511)	
AR3res_lagged			0.0099 (0.0513)
N	389	389	389
R2	0.0040	0.0001	0.0001

*** p < 0.001; ** p < 0.01; * p < 0.05.

Realised Volatility

Computations

```
#avg per day for each month of any dataset
vol_SPY_daily = r.vol_daily(raw_SPY,merge=F)
head(vol_SPY_daily)
```

timestamp	r_vol_d
2013-01-02	0.00197
2013-01-03	0.00178
2013-01-04	0.0012
2013-01-07	0.000854
2013-01-08	0.00115
2013-01-09	0.000924

```
#can then filter out years, months, or days
vol_24d = year_selector(vol_SPY_daily,2024)
vol_24_08d = month_selector(vol_SPY_daily,2024,08)
vol_24_11_04d = day_selector(vol_SPY_daily,2024,11,04) #scalar
```

```
#avg per hour for each day of each month of any dataset
vol_SPY_hourly = r.vol_hourly(raw_SPY,merge=F)
head(vol_SPY_hourly)
```

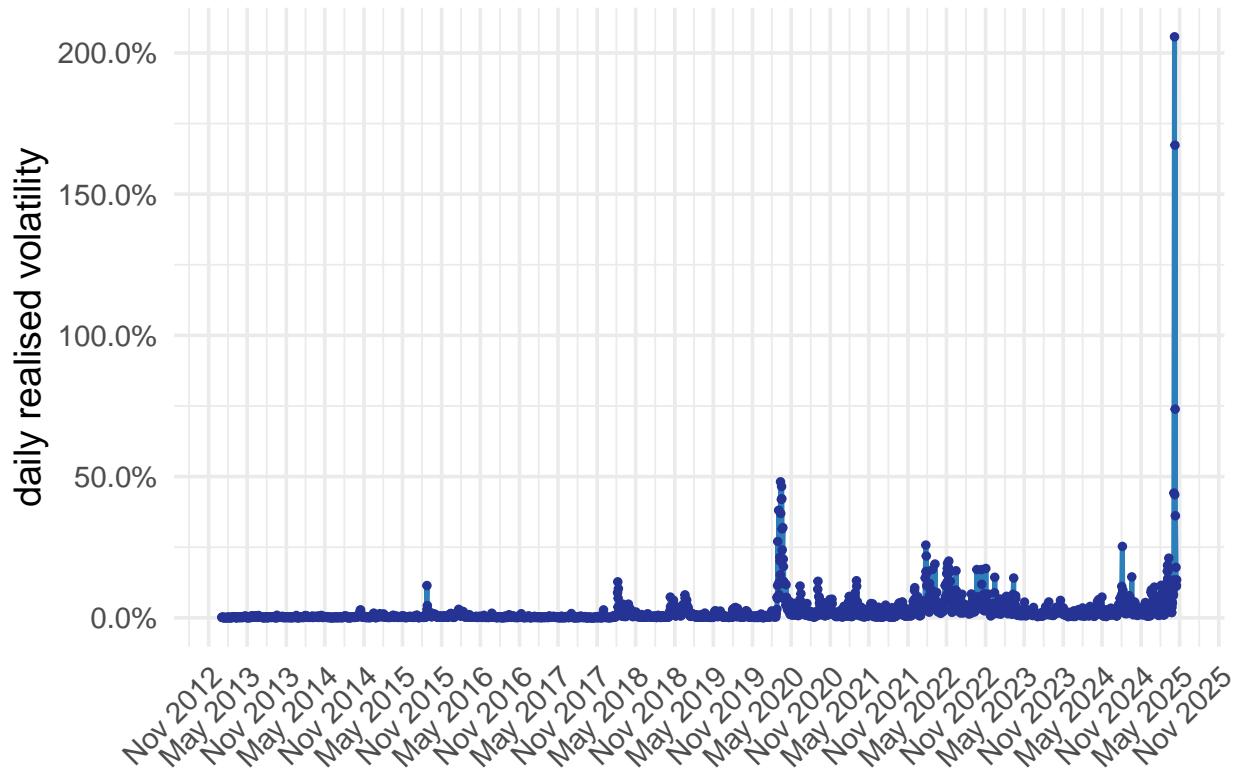
timestamp	r_vol_h
2013-01-02 09:00:00	0.00403
2013-01-02 10:00:00	0.00251
2013-01-02 11:00:00	0.00183
2013-01-02 12:00:00	0.00109
2013-01-02 13:00:00	0.001
2013-01-02 14:00:00	0.00149

```
#can then filter out years, months, or days
vol_24h = year_selector(vol_SPY_hourly,2024)
vol_24_08h = month_selector(vol_SPY_hourly,2024,08)
vol_24_11_04h = day_selector(vol_SPY_hourly,2024,11,04) #vector
```

Plots

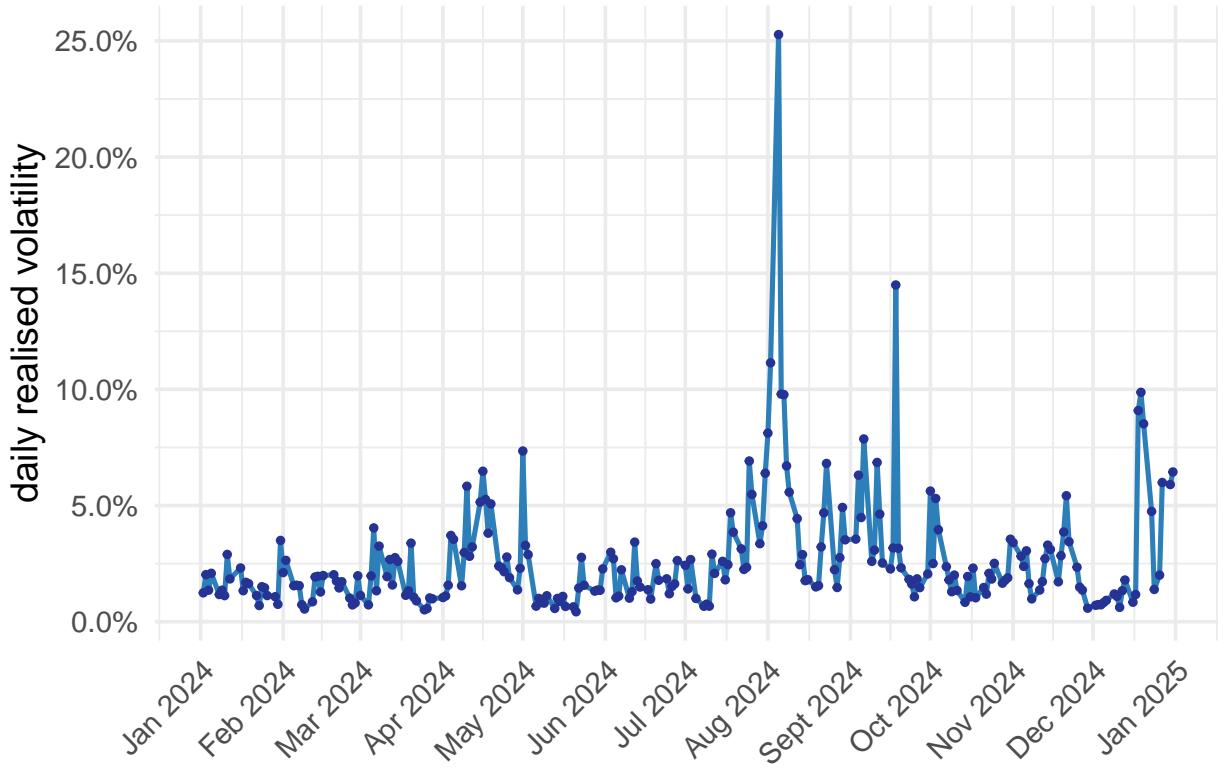
```
#avg per day volatility all time
dvol_plotter(vol_SPY_daily,breaks="yearly",
             title="SPY Volatility Over Time")
```

SPY Volatility Over Time



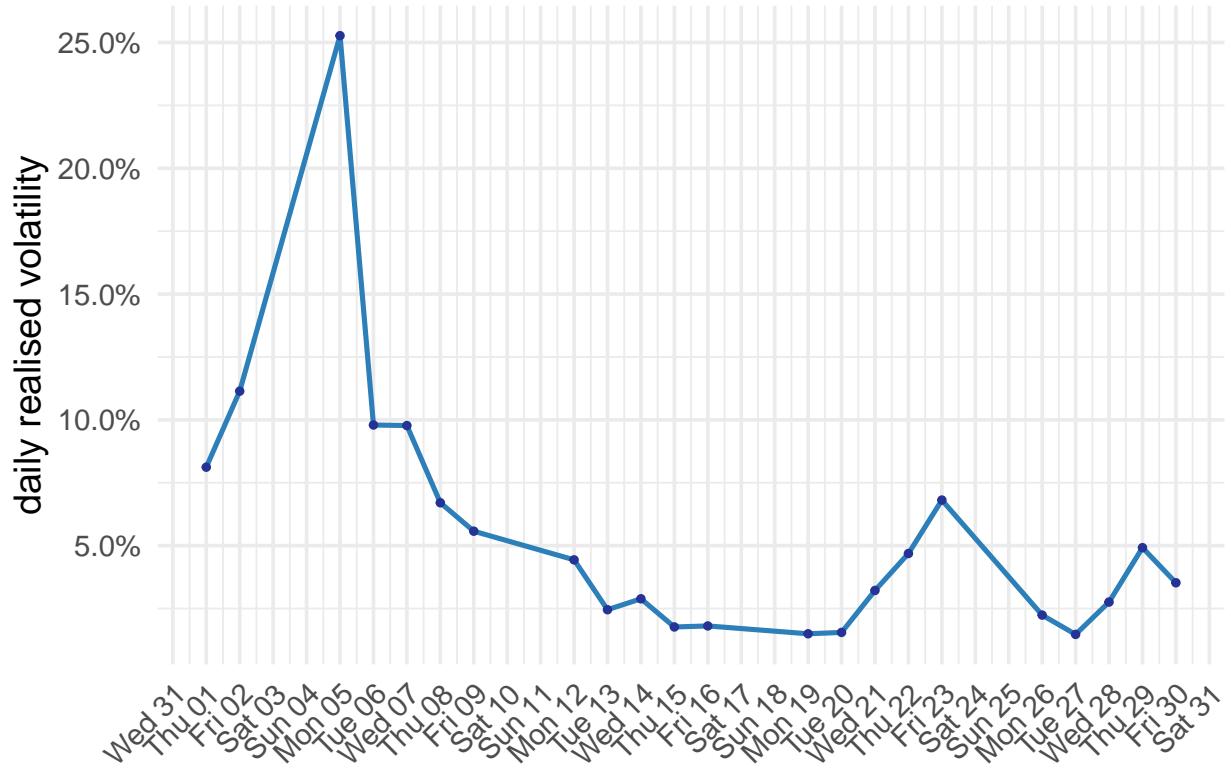
```
#avg per day volatility in a year  
dvol_plotter(vol_24d, breaks="monthly",  
             title="Realised Volatility - SPY 2024")
```

Realised Volatility – SPY 2024



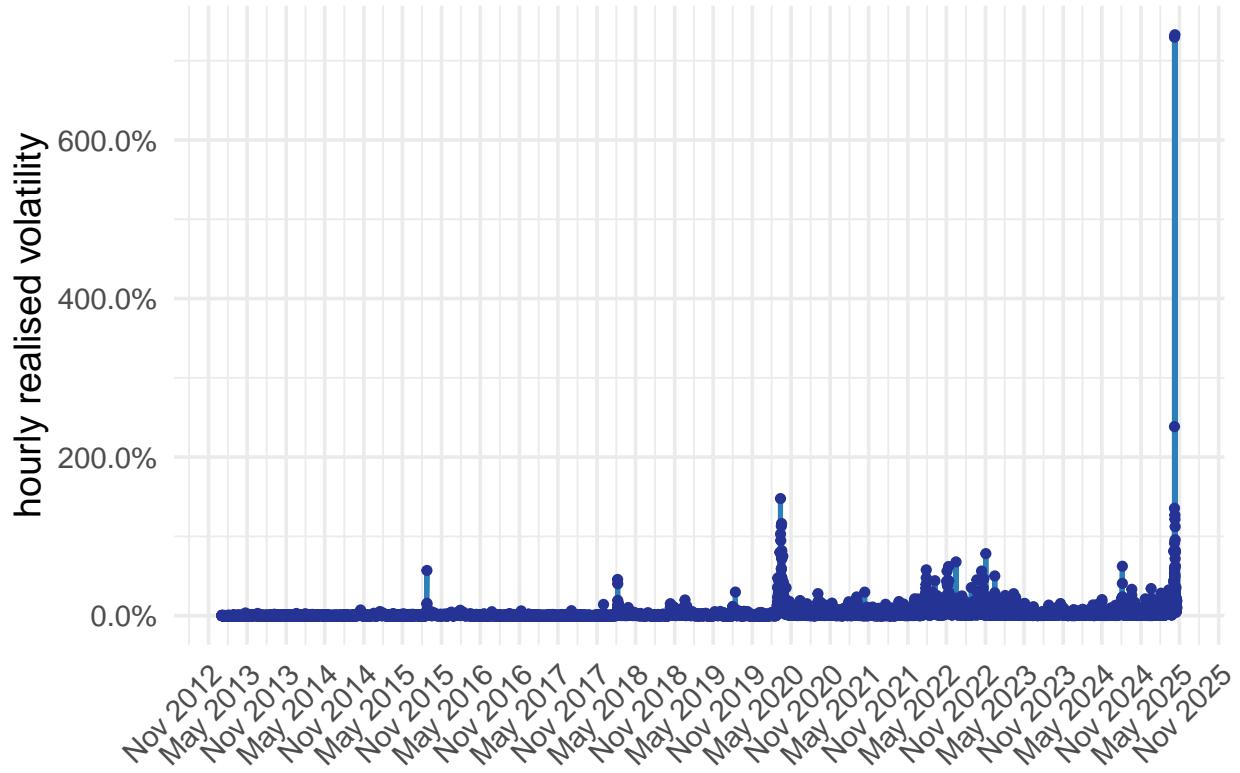
```
#avg per day volatility in a month  
dvol_plotter(vol_24_08d,breaks="daily",  
             title="Realised Volatility - SPY August 2024")
```

Realised Volatility – SPY August 2024



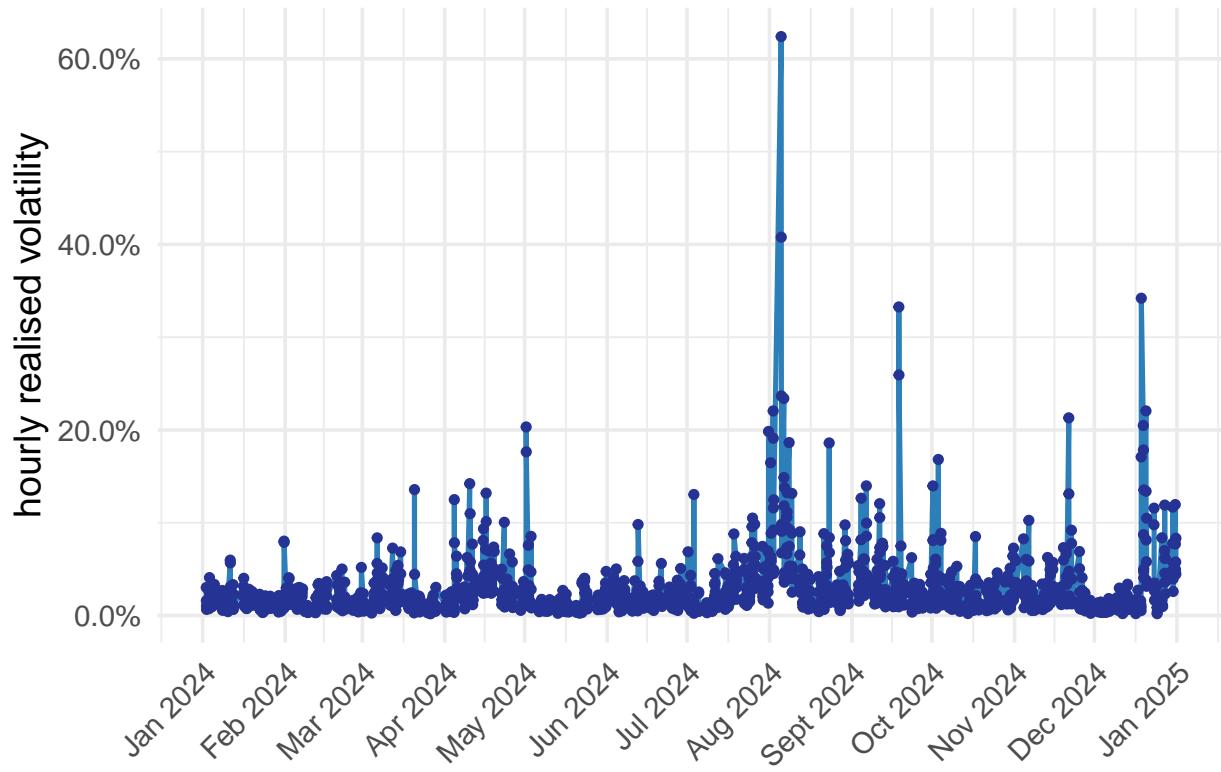
```
#hourly volatility all time
hvol_plotter(vol_SPY_hourly, breaks="yearly",
             title="SPY Volatility Over Time")
```

SPY Volatility Over Time



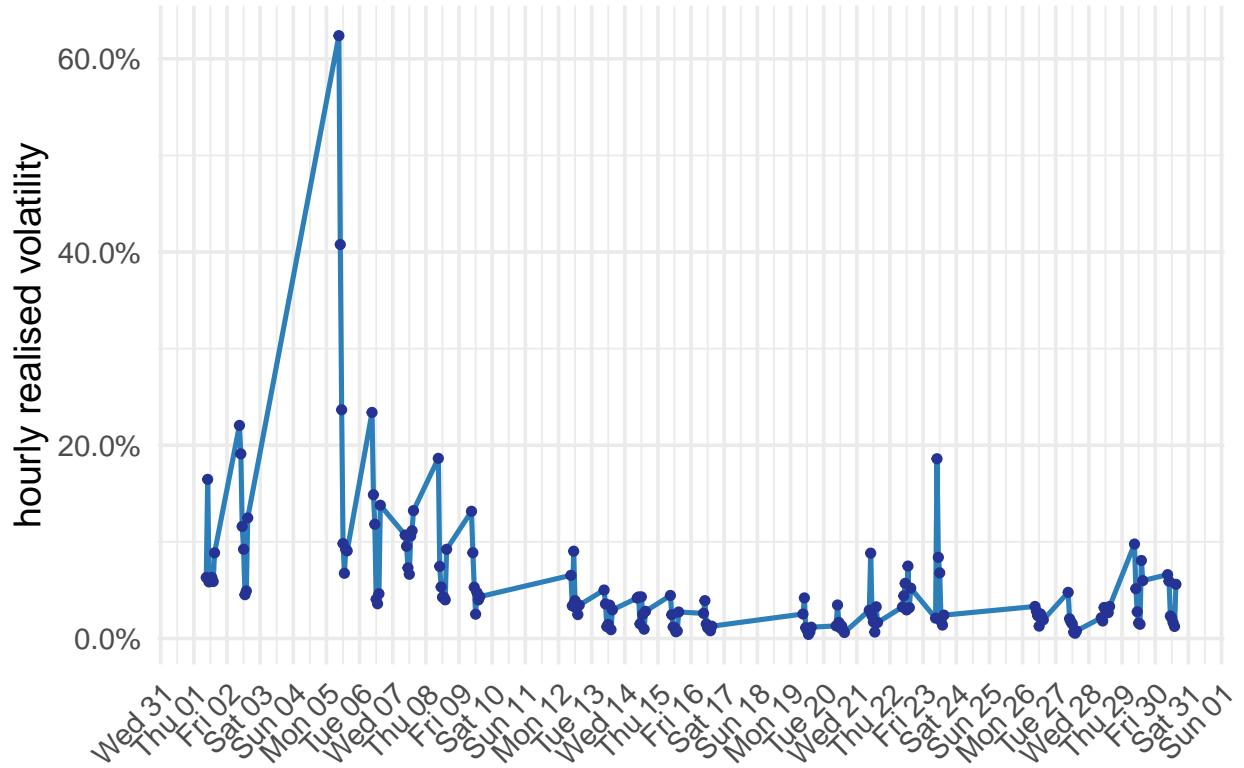
```
#hourly volatility in a year  
hvol_plotter(vol_24h, breaks="monthly",  
             title="Realised Volatility - SPY 2024")
```

Realised Volatility – SPY 2024



```
#hourly volatility in a month  
hvol_plotter(vol_24_08h,breaks="daily",  
             title="Realised Volatility - SPY August 2024")
```

Realised Volatility – SPY August 2024



```
#hourly volatility in a day
hvol_plotter(vol_24_11_04h, breaks="hourly",
             title="Realised Volatility - SPY 4th of November 2024")
```

Realised Volatility – SPY 4th of November 2024

