

# Group 3-B JP Morgan & S&P 500

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## 1 Group 3-B R Jupyter Notebook Analysis of JP Morgan Data & Linear Regression S&P 500

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```
In [ ]: #importing the JP Morgan Stock price data from february 1st 2018 to december 30 2018
        jp_morgan_stock <- read.csv("JPM.csv")
        # Loading the Data
        jp_morgan_stock
```

```
In [5]: install.packages("Quandl")
        # calaculating the Average stock price on Adjusted close price
        mean(jp_morgan_stock$Adj.Close)
```

Installing package into 'C:/Users/HP/Documents/R/win-library/3.6'  
(as 'lib' is unspecified)

Warning message:

"package 'Quandl' is in use and will not be installed"

105.67118490393

**Mean JP Morgan Adjusted Close = 105.67118490393**

```
In [6]: # Loading Library
        library(Quandl)

        # selecting the Adjusted close price
```

```

price <- jp_morgan_stock$Adj.Close
# the lenght of the duration (number of the days considered)

n <- length(jp_morgan_stock$Adj.Close)

# the daily return of the stocks (P(n)/P(n-1))-1

simple_return_daily <-(price[-n]/price[-1]) -1

# Natural logrithm daily Return of the Stock

log_Daily_Return <- log(price[-n]/price[-1])

# the daily simple standard deviation

volatility_daily <- sd(simple_return_daily)

Annualize_volatility <-volatility_daily*sqrt(n-1)

Annualize_volatility

0.218344329541622

```

**Annnualized Volatility = 0.218344329541622**

In [7]: *#daily stock return*

```
daily_stock_return <- simple_return_daily
```

```
daily_stock_return
```

```
# daily Log Stock return
```

```
log_Daily_Return
```

```

1. 0.0226637015394417 2. 0.0503677042763975 3. -0.0295246977841138 4. -0.00673336693348414
5. 0.0462552806027376 6. -0.0196293121771386 7. -0.0152139954391661 8. -0.00613714125444054
9. -0.0226027244134807 10. -0.00415558749398071 11. 0.00723759431398907
12. -0.00026151141648223 13. -0.00416706778793585 14. 0.00182637300698629
15. -0.0198616916502234 16. -0.0122928234397897 17. 0.0120142862085857 18. 0.0161039242005403
19. 0.0182491181163944 20. 0.00097078606280232 21. -0.0151225524160058
22. -0.00086844513462403 23. 0.00374798066802429 24. -8.7147681244848e-05
25. -0.0279565385048667 26. 0.0032295883944784 27. 0.0121290131200198 28. 0.0113093663893242
29. -0.00251661983602869 30. -0.0017324671445893 31. 0.00794546857259326
32. -0.000959543562491949 33. -0.00087148601689313 34. 0.0435653254057209
35. 0.0274740198033818 36. -0.0299156747549069 37. 0.0197837762917465 38. 0.00157389930484664
39. -0.0179139389181201 40. 0.0196569658204568 41. -0.0135370881311609 42. -0.014956206832877
43. -0.0129603054825433 44. 0.0255751860443305 45. -0.0118659341636872 46. -0.0187539321711062
47. 0.0170854222858925 48. -0.0242567899530048 49. 0.027833198524909 50. 0.000816671466774777
51. 0 52. 0.00814126277278127 53. -0.0214823397981769 54. 0.00224274277368841

```

55.	0.00486794989327288	56.	0.0047097079141678	57.	0.00381857175553302
58.	-0.000999089754914473	59.	0.00639849044415186	60.	0.00569966794842425
61.	0	62.	0.00796882349263539	63.	0.00634092196478009
64.	-0.010974774880991	65.	-0.00859471154625857	66.	-0.0145958804908491
67.	-0.0213387289348089	68.	-0.00769954879405454	69.	0.0037765104648313
70.	-0.000351151832533647	71.	0.00769722113550664	72.	-0.00273517687635039
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76.	-0.00760983166969043	77.	0.00462262335493757	78.	0.0113277215727239
79.	0.00515091839559845	80.	0.0446522286510092	81.	-0.0223349630962466
82.	0.0125221074743125	83.	-0.012822877195928	84.	-0.000460981161928387
85.	0.00565656790850477	86.	-0.0228344632619354	87.	-0.00397111118373483
88.	-0.00279007205656789	89.	0.00252636930673678	90.	0.0058081880489258
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94.	-0.00258833361599153	95.	0.0058578064183914	96.	9.30408875128297e-05
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130.	-0.00203756062385019	131.	0.00778588199051677	132.	0.00993680719814427
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136.	-0.00932302337906421	137.	0	138.	0.00130873081340543
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1.	0.0224106954253712	2.	0.0491402974145827	3.	-0.0299693252122067
4.	-0.006756138324934	5.	0.0452173899798865	6.	-0.019824525956635
7.	-0.0153309156661326	8.	-0.00615605091302418	9.	-0.0228620815588897
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22.	-0.000868822451568482	23.	0.00374097448903916	24.	-8.71514788246562e-05
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43.	-0.0130450230144366	44.	0.0252536123170144	45.	-0.0119368962735814
46.	-0.0189320172016819	47.	0.0169411079205009	48.	-0.0245558316471412
49.	0.0274528956234283	50.	0.000816338172081621	51.	0
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67.	-0.021569691147805	68.	-0.00772934335485378	69.	0.00376939735205771
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76.	-0.00763893417617162	77.	0.00461197184426427	78.	0.0112640433694579
79.	0.00513769779482941	80.	0.0436840344787729	81.	-0.0225881656665956
82.	0.0124443543027178	83.	-0.0129057999203655	84.	-0.000461087446408897
85.	0.00564062960407385	86.	-0.0230992075781503	87.	-0.00397901698256333
88.	-0.00279397156256574	89.	0.00252318340052206	90.	0.00579138555469056
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100.	-0.000667894091023182	101.	0.0155697199056869	102.	-0.0162370880983711
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109.	0.00617108367177508	110.	0.00215949891169925	111.	-0.00431434443503153
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118.	-0.0184308869579886	119.	-0.0070328796893951	120.	-0.00898289308339207
121.	0.00286920875387494	122.	-0.0102218327407465	123.	-0.00601478844294525
124.	0.0153663328805257	125.	-0.0061575802918544	126.	-0.00422759591536885
127.	-0.00806043870233712	128.	-0.000256286422759277	129.	-0.00366463586386818
130.	-0.00203963927456264	131.	0.00775572842493625	132.	0.0098877617652133

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136.	-0.00936675477966843	137.	0	138.	0.00130787517168955
140.	0.00303971159003269	141.	0.00208964739924999	142.	0.000435856536983607
143.	-0.0175464817768391	144.	0.00489584628938499	145.	0.00327724064637043
146.	0.00493619634102436	147.	0.00530967344683807	148.	-0.00496240146420173
149.	0.00487514250806288	150.	0.00428513554520733	151.	-0.00192626592103012
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158.	-0.00403257030857594	159.	-0.0286324886345512	160.	-0.00855033874741494
161.	0.00659674995483046	162.	0.00963483263830889	163.	0.00283129914688536
164.	0.0118405241986487	165.	0.00435659572267371	166.	0.0147784989411107
167.	-0.00583184466697562	168.	-0.00413242429309026	169.	-0.00934474115569894
170.	-0.00897552545939304	171.	0.00565480842980534	172.	-0.00608864169297101
173.	0.00696151806418074	174.	0.0269938388195984	175.	0.0304214340354888
176.	0.0109726615045736	177.	0.00571995692830933	178.	-0.0212139984097809
179.	-0.0110782152155738	180.	0.0159696127006219	181.	0.00166654435316787
182.	0.0144679861036453	183.	0.010491164837237	184.	0.0187978395255199
185.	-0.0150855798072133	186.	0.0138277878358425	187.	-0.0137324118696705
188.	-0.0174902776524726	189.	-0.0215101733057418	190.	0.000366853431126274
191.	0.00552083215287506	192.	-0.00652959564924659	193.	-0.00466426655114889
194.	-0.0170078669592143	195.	-0.00804067280562333	196.	0.00974656947605091
197.	0.0212503263957662	198.	-0.00585703887430163	199.	0.020837880782797
200.	-0.0252083061598145	201.	0.000727112110838559	202.	-0.00760811270859792
203.	0.0217083385768237	204.	0.00749689749959561	205.	0.00923981066612782
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209.	0.00796387003194709	210.	-0.0102147919335159	211.	-0.0093989535291332
212.	0.0456633038371436	213.	0.0192078722029486	214.	0.0182276476975578
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218.	-0.000989549301374527	219.	0.00824209370212635	220.	0.0128450706544403
221.	0.00475824885100211	222.	0.0127664329413698	223.	0.00867147449321486
224.	0.0239230289003242	225.	0.0217923836316605	226.	-0.0406221479351887
227.	-0.0111918951586253	228.	0.0021663591314553		

### 1.0.1 Linear Regression of S&P 500 Data

```
In [8]: # Importing the the S&P 500
        sp_500 <-read.csv("^GSPC.csv")
        sp_500
```

Date	Open	High	Low	Close	Adj.Close	Volume
2018-02-01	2816.45	2835.96	2812.70	2821.98	2821.98	3938450000
2018-02-02	2808.92	2808.92	2759.97	2762.13	2762.13	4301130000
2018-02-05	2741.06	2763.39	2638.17	2648.94	2648.94	5283460000
2018-02-06	2614.78	2701.04	2593.07	2695.14	2695.14	5891660000
2018-02-07	2690.95	2727.67	2681.33	2681.66	2681.66	4626570000
2018-02-08	2685.01	2685.27	2580.56	2581.00	2581.00	5305440000
2018-02-09	2601.78	2638.67	2532.69	2619.55	2619.55	5680070000
2018-02-12	2636.75	2672.61	2622.45	2656.00	2656.00	4055790000
2018-02-13	2646.27	2668.84	2637.08	2662.94	2662.94	3472870000
2018-02-14	2651.21	2702.10	2648.87	2698.63	2698.63	4003740000
2018-02-15	2713.46	2731.51	2689.82	2731.20	2731.20	3684910000
2018-02-16	2727.14	2754.42	2725.11	2732.22	2732.22	3637460000
2018-02-20	2722.99	2737.60	2706.76	2716.26	2716.26	3627610000
2018-02-21	2720.53	2747.75	2701.29	2701.33	2701.33	3779400000
2018-02-22	2710.42	2731.26	2697.77	2703.96	2703.96	3701270000
2018-02-23	2715.80	2747.76	2713.74	2747.30	2747.30	3189190000
2018-02-26	2757.37	2780.64	2753.78	2779.60	2779.60	3424650000
2018-02-27	2780.45	2789.15	2744.22	2744.28	2744.28	3745080000
2018-02-28	2753.78	2761.52	2713.54	2713.83	2713.83	4230660000
2018-03-01	2715.22	2730.89	2659.65	2677.67	2677.67	4503970000
2018-03-02	2658.89	2696.25	2647.32	2691.25	2691.25	3882450000
2018-03-05	2681.06	2728.09	2675.75	2720.94	2720.94	3710810000
2018-03-06	2730.18	2732.08	2711.26	2728.12	2728.12	3370690000
2018-03-07	2710.18	2730.60	2701.74	2726.80	2726.80	3393270000
2018-03-08	2732.75	2740.45	2722.65	2738.97	2738.97	3212320000
2018-03-09	2752.91	2786.57	2751.54	2786.57	2786.57	3364100000
2018-03-12	2790.54	2796.98	2779.26	2783.02	2783.02	3185020000
2018-03-13	2792.31	2801.90	2758.68	2765.31	2765.31	3301650000
2018-03-14	2774.06	2777.11	2744.38	2749.48	2749.48	3391360000
2018-03-15	2754.27	2763.03	2741.47	2747.33	2747.33	3500330000
...	...	...	...	...	...	...
2018-11-14	2737.90	2746.80	2685.75	2701.58	2701.58	4402370000
2018-11-15	2693.52	2735.38	2670.75	2730.20	2730.20	4179140000
2018-11-16	2718.54	2746.75	2712.16	2736.27	2736.27	3975180000
2018-11-19	2730.74	2733.16	2681.09	2690.73	2690.73	3772900000
2018-11-20	2654.60	2669.44	2631.52	2641.89	2641.89	4357900000
2018-11-21	2657.74	2670.73	2649.82	2649.93	2649.93	3233550000
2018-11-23	2633.36	2647.55	2631.09	2632.56	2632.56	1651650000
2018-11-26	2649.97	2674.35	2649.97	2673.45	2673.45	3443950000
2018-11-27	2663.75	2682.53	2655.89	2682.17	2682.17	3485220000
2018-11-28	2691.45	2744.00	2684.38	2743.79	2743.79	3951670000
2018-11-29	2736.97	2753.75	2722.94	2737.80	2737.80	3560770000
2018-11-30	2737.76	2760.88	2732.76	2760.17	2760.17	4658580000
2018-12-03	2790.50	2800.18	2773.38	2790.37	2790.37	4186060000
2018-12-04	2782.43	2785.93	2697.18	2700.06	2700.06	4499840000
2018-12-06	2663.51	2696.15	2621.53	2695.95	2695.95	5141470000
2018-12-07	2691.26	2708.54	2623.14	2633.08	2633.08	4216690000
2018-12-10	2630.86	2647.51	2583.23	2637.72	2637.72	4151030000
2018-12-11	2664.44	2674.35	2621.30	2636.78	2636.78	3905870000
2018-12-12	2658.23	2685.44	2650.26	2651.07	2651.07	3958890000
2018-12-13	2658.70	2670.19	2637.27	2650.54	2650.54	3927720000
2018-12-14	2629.68	2635.07	2593.84	2599.95	2599.95	4035020000

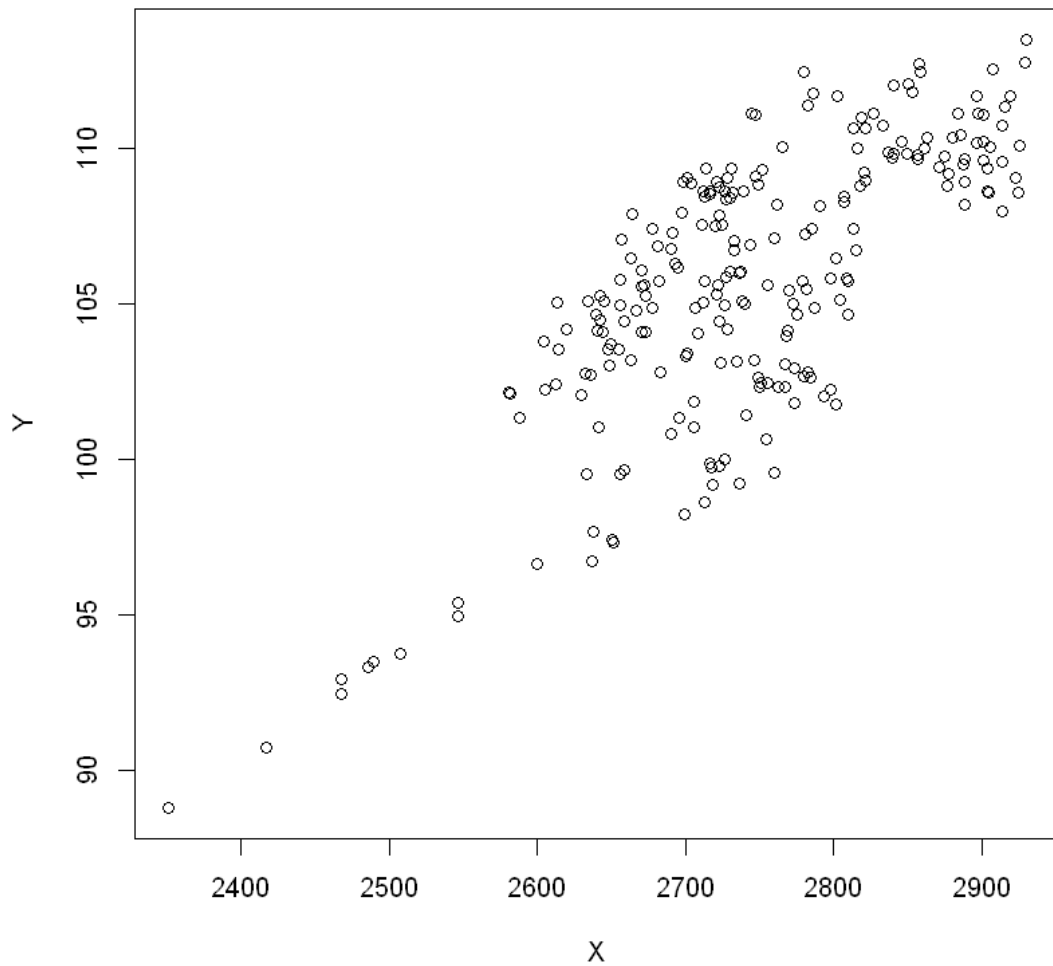
```
In [9]: #Assign x to the explanatory variable
X <- sp_500$Adj.Close
# assign y to the explained variable
Y<- jp_morgan_stock$Adj.Close

# creating a table for the explained and Explanatory variables
X_Y <- cbind(X,Y)
X_Y
```

X	Y
2821.98	110.6600
2762.13	108.2076
2648.94	103.0188
2695.14	106.1529
2681.66	106.8725
2581.00	102.1477
2619.55	104.1929
2656.00	105.8026
2662.94	106.4559
2698.63	108.9178
2731.20	109.3723
2732.22	108.5864
2716.26	108.6148
2701.33	109.0693
2703.96	108.8704
2747.30	111.0766
2779.60	112.4590
2744.28	111.1240
2713.83	109.3628
2677.67	107.4028
2691.25	107.2986
2720.94	108.9462
2728.12	109.0409
2726.80	108.6337
2738.97	108.6432
2786.57	111.7678
2783.02	111.4080
2765.31	110.0729
2749.48	108.8420
2747.33	109.1166
...	...
2701.58	103.41650
2730.20	106.05659
2736.27	105.97950
2690.73	106.78888
2641.89	104.49565
2649.93	103.71519
2632.56	102.76129
2673.45	105.27612
2682.17	105.71935
2743.79	106.89487
2737.80	106.04695
2760.17	107.13575
2790.37	108.14746
2700.06	103.32014
2695.95	101.35452
2633.08	99.52380
2637.72	97.66419
2636.78	96.71027
2651.07	97.33656
2650.54	97.43293
2599.95	96.63318



```
In [10]: #to check if there is a Linear relationship between the the two  
plot(X,Y)
```



```
In [11]: linear_regression = lm(Y~ X )  
  
linear_regression  
summary(linear_regression)
```

```
Call:  
lm(formula = Y ~ X)
```

```
Coefficients:
```

(Intercept)	X
13.55492	0.03358

Call:

lm(formula = Y ~ X)

Residuals:

Min	1Q	Median	3Q	Max
-6.6587	-2.3631	0.4766	2.3498	5.5676

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	13.554920	5.219148	2.597	0.01 *
X	0.033579	0.001901	17.662	<2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.928 on 227 degrees of freedom

Multiple R-squared: 0.5788, Adjusted R-squared: 0.5769

F-statistic: 311.9 on 1 and 227 DF, p-value: < 2.2e-16