Long-Term Association in Time Series and Simultaneous Equation Modelling: A Case Study

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Abstract

Simultaneity (Endogeneity) is a normal phenomenon observed in financial data. Modelling of more than one endogenous variable in a single equation using OLS (Optimum Lead Square) is faulty due to the violation of the assumptions of OLS estimator. Therefore, systems of equation (Simultaneous equation modelling) is used instead to OLS. *Two stage least square* (TSLS) or *Generalized method of moments* (GMM) is used to estimate systems of equation. This case study highlights the usage of TSLS to estimate systems of equations.

Keywords: Call, Futures, Put, TSLS, Volatility

1. Introduction

Derivatives are considered to be a risk for the spot markets (Brock, Hommes and Wagener, 2009). Governments also gets worried that spot market volatility is adversely affected by trading in the derivatives markets. Even legendary investor Warren Buffett described in his letter to the shareholders in 2002 that derivatives are financial weapons of mass destruction. However, there are studies which give contradictory evidence that derivatives trading does not impact the volatility in the spot market (Shenbagaraman, 2003; Fattouh, Kilian & Mahadeva, 2013; Weaver & Banerjee, 1990).

2. What are Derivatives?

Derivative is a financial tool that protects people from the risk that arises due to uncertain price changes of an asset. For example, consider that a farmer and a miller agree on a specific price of a commodity which is to be delivered within a certain period of time in future. Although, both parties enter into an agreement, but they are still exposed to the risk of price changes in the futures, because there are two possibilities in such cases. If at the time of delivery, the current price of the commodity is high in the market, farmer will be at loss as he has already decided to sell it at the fixed priced. On the other hand, if the prices are low, miller will be at loss. Entering into this type of financial contracts to hedge against risks that arise due to fluctuating prices is called derivatives. Since their values are derived from their underlying assets, hence they are known as derivatives. There are many ways in which risk can be hedged against the securities (Securities include stocks, commodities, interest rates, exchange rates etc). Though there are different types of derivatives, the important among them are *Forwards*, *Futures*, *Options* and *Swaps*. However, it is seen that informed investors prefer to invest in options market but not in the futures market (investment into derivatives for hedging).

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Since, the driving force to enter into derivatives is volatility between different markets, let us discuss how these markets affect each other's volatility. There is limited study of spot market with the integration of futures market however, there is enough evidence to prove that futures market impact the volatility of the spot market. There are studies which show that with the introduction of futures, spot market volatility has been changed, resulting in change in the market efficiency of the spot market. On the other hand, there are studies denying this. However, volatility has slowed down due to introduction of futures. Moreover, it has also been observed that volatility of future markets is more than spot market.

There are numerous studies which demonstrate the link between spot market and option market. There are proofs that options market helps in discovery of the spot markets. Till a certain level of option price, volatility of the spot market is not affected. As soon as the price of the options market increases, crossing the threshold, spot market volatility goes down. Due to this factor, spot market takes lead over option market.

The study between futures market and options market is relatively less as compared to the other markets. Studies have a shown that there is a relationship between futures market and option market. There are evidences of co-movement in prices between futures market and option markets. But there is hardly any study about their volatility.

After understanding the volatility between two markets, let us discuss all the three markets together. There are very limited studies of these three markets together (Rastogi & Athaley, 2019). One of the earlier works studied that derivatives under normal circumstances do not affect spot market. Whereas under extreme events, for example; political change in the power, financial crises, they affect the spot market. In some other studies it was seen that futures market take lead on spot and options markets. Whereas in others, it was seen that spot market takes leads on futures and options. Also, in some of the cases it was options market who took lead on futures market and spot market.

One of the study done on Indian markets, it was seen that futures markets and options markets take lead on spot market. However, between futures market and options market, options market lead for futures market, for calls and futures market lead over options markets for put. Nevertheless, none of the studies show volatility among these three markets together. Volatility of spot market did not change much by the introduction of futures markets and options markets. Volatility of spot market do not affect by derivative in the normal scenario. It is observed that spot volatility interpretation is only linked to option volatility. Options market volatility is considered while studying spot market volatility. There is not enough evidence to show that futures markets affect spot market alone with options market.

3. Derivatives Markets Affects Spot Market

Options markets do affect spot market because of the hedging done by the investors to protect their investment. Large institutions betting with simple speculation does impact the spot market. For example, consider that you are buying call options contracts which are due to expire in one month. The other party selling the option would want them to expire out of the money. As we get close to the expiry of the contract, to safeguard the interest of the entity, the spot market should stay below the strike price. In this case, the buyer wants to see these contracts in the money. This can only happen when there is certain influence on the spot market. Options market can hence influence the spot market.

Hedge is to reduce loss or to guarantee a profit even in the worst case scenario. The Options derive their value from the underlying cash market and it is also useful to know that the options delta reflects the investors equivalent exposure in the cash market, so as long as the cash value can be pushed higher, then the options delta will increase.

Big argument for today is that options derive value from the asset not the other way round. Derivatives get the value from the spot market, in what ways; spot derives their values from the derivatives market. In the derivatives market, all the instruments derive their value by the underlying asset, which is there by design. But derivatives market impact the spot market is neither by design nor does by choice. In-spite-of this, the debate is on whether derivatives market impacts the spot market or not.

The concerns of the authorities for adverse impact of derivatives on spot markets are there in India as well. The evidence of the adverse impact needs to be statistically proven. Therefore, data of derivatives as well as spot market needs to be studies to figure out the impact. This is a valid observation that market efficiency of the securities market also does not remain same rather this keeps on changing (Adaptive Market Hypothesis [AMH] proves this point well) (Neely, Weller & Ulrich, 2009). The existence of AMH supports the argument that during a period market may be efficient and find no evidence of derivatives market impact on the spot market. Whereas, in the other period, during the inefficient phase of the market, derivatives may impact the spot market adversely. In-spite-of this observation, market should be tested to explore the impact of derivatives market on the spot market.

Market reflects prices. But, the future price is related to the possibility of changes in the price. Change in the prices or possibility of change in the prices is studies with the help of volatility. There are several methods to measure the volatility. Volatility of time series can be measured by estimating standard deviation or variance. However, the measurement of volatility is not a static concept rather it is a dynamic concept. Means, the volatility can be measure for every period rather than estimating volatility during a given time period.

There are several popular methods to estimate volatility for every period. Conditional volatility is one such concept. The time series has heteroscedasticity with respect to time, which is also known as ARCH (Autoregressive Conditional Heteroscedasticity) effect. GARCH (1,1) model can serve the purpose. However, asymmetry, fat tails and volatility clustering are also the hallmark of a financial time series. Therefore, asymmetric

models EGARCH can be used to estimate the volatility. But before the volatility is measured by EGARCH methods, prices of the securities should be known.

NSE (National Stock Exchange) in India trades in securities since 1994. Derivatives trading at NSE also started in phases from the 2000. To understand the impact of volatility of derivatives markets (futures and options markets) on the spot market, the leading index of NSE, Nifty-50 can serve the purpose well. EGARCH models can be used to find conditional variance series of index, futures and options (for both call and put options, separately). Descriptive statistics is normal and discussed for both, return and variance series, in (Table 1).

Volatility integration in time series can be studied by the long-term association measures like VAR (Vector Auto Regressive) models. Cointegration among the series will ensure the long-term association. Johansen's cointegration test can do the work. One of the eligibility criteria to explore the long-term association through cointegration isthat the times series should be I (1) in levels. Table 2 elaborates that all the four time series taken into consideration are I (0) at levels. This means, cointegration test cannot be used to describe the long-term association among the given all the four time series. To know the impact of contemporaneous terms of one time series on the other, VAR model cannot be used. Therefore, to know the long-term association among the given index, futures, call and put return time series, the only solution left is multiple regression. But literature has evidence that there is simultaneity among the three markets in the price series.

Hausman tests can be deployed to test the simultaneity among the given four time series separately. The system of equations models is developed of the following forms (Equation 1 to Equation 4).

Table 1. Descriptive statistics (returns and variances)

Series	Return Series					Variance Series				
	Mean	**Std Dev**	**Median**	**JB Statistic**	**p-value**	**Mean**	**Std Dev**	**Median**	**JB Statistic**	**p-value**
Index	0.001696	0.021839	0.002133	0.256247	0.879745	0.000472	0.000203	0.000422	206.1839	0
Futures	0.001702	0.022112	0.002686	0.86255	0.64968	0.000485	0.000219	0.000427	258.8781	0
Call	0.000547	0.390797	-0.020401	37399.64	0	0.143263	0.440201	0.086693	2364157	0
Put	0.000535	0.436748	-0.002701	3103.087	0	0.2148	0.899672	0.135763	2182368	0

Table 2. Unit root tests (Augmented Dickey-Fuller Test)

SN	Series	Return Series		Variance Series	
		t-statistics	p-value*	t-statistics	p-value
1	Index	-19.5918	0.0000	-5.3410	0.0000
2	Futures	-19.2066	0.0000	-5.5063	0.0000
3	Call	-18.7123	0.0000	-20.1831	0.0000
4	Put	-17.5983	0.0000	-20.1244	0.0000

* Significant at 5% level

$$Index = \alpha_1 + futures + call + put + index_{-1} + futures_{-1} + call_{-1} + put_{-1} \qquad \text{Equation 1}$$

$$futures = \alpha_2 + index + call + put + index_{-1} + futures_{-1} + call_{-1} + put_{-1} \qquad \text{Equation 2}$$

$$call = \alpha_3 + index + futures + put + index_{-1} + futures_{-1} + call_{-1} + put_{-1} \qquad \text{Equation 3}$$

$$put = \alpha_4 + index + futures + call + index_{-1} + futures_{-1} + call_{-1} + put_{-1} \qquad \text{Equation 4}$$

Where

Index   *Index variance series (V_index)*
Futures *Futures variance series (V_futures)*
Call   *Call options variance series (V_call)*
Put   *Put options variance series (V_put)*

The lag terms of the all the four Time Series (TS) variables are taken as exogenous variables. Lag terms are pre-determined variables therefore they can be used as exogenous variables (stochastic variables). The determination of the lag terms can be done through the information criteria.

Table 3 reports the results of the Hausman test for all the four equations (Equation 1 to 4). Interestingly, Nifty-Index and Nifty-futures are having simultaneity with futures, call options and put options. But, both the options series (call and put) do not have simultaneity with index and futures series. This implies that Equation 1 and 2 cannot be estimated with OLS (Optimum Least Square) method. Rather, they can be estimated with other methods which can check the simultaneity and estimate the models. Two-Stage Least Square (TSLS) method can be used in such situation (Table 4 A and 4 B). Because there is no evidence of simultaneity for the equation 3 and 4, they can be estimated by usual OLS method (Table 4 C and 4 D).

Table 3. Hausman tests

A. Index Variances				
Dependent Variable: V_INDEX				
Method: Least Squares				
Date: 06/07/19 Time: 23:42				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.88E-05	2.21E-07	-265.9127	0.0000
V_FUTURES	0.999598	0.000452	2211.448	0.0000
V_CALL	5.04E-09	9.08E-08	0.055552	0.9557
V_PUT	-3.63E-09	4.43E-08	-0.081811	0.9348

V_INDEX(-1)	-0.294583	0.003588	-82.10143	0.0000
V_FUTURES(-1)	-0.587241	0.001864	-315.0534	0.0000
V_CALL(-2)	7.97E-10	8.91E-08	0.008939	0.9929
V_PUT(-1)	3.14E-06	4.45E-08	70.59239	0.0000
V_INDEX	0.996262	0.002943	338.5002	0.0000
R-squared	0.999985	Mean dependent var		0.000472
Adjusted R-squared	0.999985	S.D. dependent var		0.000204
S.E. of regression	7.93E-07	Akaike info criterion		-25.23445
Sum squared resid	2.52E-10	Schwarz criterion		-25.14613
Log likelihood	5169.445	Hannan-Quinn criter.		-25.19950
F-statistic	3361370.	Durbin-Watson stat		2.000213
Prob(F-statistic)	0.000000			

B. Futures Variances

Dependent Variable: V_FUTURES				
Method: Least Squares				
Date: 06/07/19 Time: 23:36				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.59E-05	3.34E-06	-22.73280	0.0000
V_INDEX	1.082542	0.007235	149.6313	0.0000
V_CALL	-1.68E-06	1.67E-06	-1.003527	0.3162
V_PUT	6.09E-07	8.17E-07	0.746007	0.4561
V_INDEX(-1)	-1.123397	0.054122	-20.75685	0.0000
V_FUTURES(-2)	-0.017467	0.006604	-2.644795	0.0085
V_CALL(-2)	3.43E-07	1.64E-06	0.208571	0.8349
V_PUT(-1)	3.65E-06	8.23E-07	4.440168	0.0000
V_FUTURES	1.214302	0.057984	20.94192	0.0000
R-squared	0.995628	Mean dependent var		0.000484
Adjusted R-squared	0.995541	S.D. dependent var		0.000219
S.E. of regression	1.46E-05	Akaike info criterion		-19.40713
Sum squared resid	8.55E-08	Schwarz criterion		-19.31881
Log likelihood	3977.758	Hannan-Quinn criter.		-19.37218
F-statistic	11387.54	Durbin-Watson stat		2.355886
Prob(F-statistic)	0.000000			

C. Call Variances

Dependent Variable: V_CALL		
Method: Least Squares		
Date: 06/07/19 Time: 23:35		

Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.143941	18.29991	0.007866	0.9937
V_INDEX	1567.326	1622.656	0.965901	0.3347
V_FUTURES	-1481.527	1483.666	-0.998558	0.3186
V_PUT	0.088442	0.024027	3.680963	0.0003
V_INDEX(-1)	-2221.159	103155.1	-0.021532	0.9828
V_FUTURES(-1)	2044.943	90369.73	0.022629	0.9820
V_CALL(-2)	-0.011294	0.049100	-0.230031	0.8182
V_PUT(-1)	-0.002892	0.256289	-0.011284	0.9910
V_CALL	0.126383	93.26480	0.001355	0.9989
R-squared	0.038417	Mean dependent var		0.143497
Adjusted R-squared	0.019186	S.D. dependent var		0.441263
S.E. of regression	0.437009	Akaike info criterion		1.204035
Sum squared resid	76.39091	Schwarz criterion		1.292357
Log likelihood	-237.2253	Hannan-Quinn criter.		1.238981
F-statistic	1.997608	Durbin-Watson stat		2.000506
Prob(F-statistic)	0.045536			

D. Variances Put

Dependent Variable: V_PUT				
Method: Least Squares				
Date: 06/07/19 Time: 23:30				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.234116	8.275594	-0.028290	0.9774
V_INDEX	-2443.644	3325.899	-0.734732	0.4629
V_FUTURES	2176.681	3040.021	0.716009	0.4744
V_CALL	0.370632	0.100635	3.682917	0.0003
V_INDEX(-1)	1792.914	19222.93	0.093270	0.9257
V_FUTURES(-1)	-1445.203	22862.20	-0.063214	0.9496
V_CALL(-1)	-0.002187	0.160471	-0.013626	0.9891
V_PUT(-2)	-0.006091	0.049332	-0.123461	0.9018
V_PUT	1.629497	29.00584	0.056178	0.9552
R-squared	0.035716	Mean dependent var		0.215208
Adjusted R-squared	0.016430	S.D. dependent var		0.901853
S.E. of regression	0.894414	Akaike info criterion		2.636463
Sum squared resid	319.9905	Schwarz criterion		2.724784
Log likelihood	-530.1567	Hannan-Quinn criter.		2.671409
F-statistic	1.851940	Durbin-Watson stat		2.003855
Prob(F-statistic)	0.066184			

Table 4. TSLS application

A. Index Variance/TSLS				
Dependent Variable: V_INDEX				
Method: Two-Stage Least Squares				
Date: 06/07/19 Time: 23:52				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Instrument specification: V_INDEX(-1) V_FUTURES(-1) V_CALL(-1) V_PUT(				
-1) V_INDEX(-2) V_FUTURES(-2) V_CALL(-2)				
Constant added to instrument list				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.80E-05	0.000294	0.061413	0.9511
V_FUTURES	0.856882	1.251594	0.684633	0.4940
V_CALL	-0.000263	0.002019	-0.130419	0.8963
V_PUT	0.000150	0.000765	0.196149	0.8446
V_INDEX(-1)	0.314287	2.968800	0.105863	0.9157
V_FUTURES(-1)	-0.214118	2.544836	-0.084138	0.9330
V_CALL(-1)	-1.99E-07	1.92E-05	-0.010356	0.9917
V_PUT(-1)	-1.10E-06	1.15E-05	-0.095772	0.9237
R-squared	0.360209	Mean dependent var		0.000472
Adjusted R-squared	0.349041	S.D. dependent var		0.000204
S.E. of regression	0.000164	Sum squared resid		1.08E-05
F-statistic	68.02366	Durbin-Watson stat		2.000085
Prob(F-statistic)	0.000000	Second-Stage SSR		4.07E-06
J-statistic	7.60E-37	Instrument rank		8

B. Futures Variance/TSLS				
Dependent Variable: V_FUTURES				
Method: Two-Stage Least Squares				
Date: 06/08/19 Time: 00:01				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Instrument specification: V_INDEX(-1) V_FUTURES(-1) V_CALL(-1) V_PUT(				
-1) V_INDEX(-2) V_FUTURES(-2) V_CALL(-2)				
Constant added to instrument list				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.64E-05	0.001014	-0.095072	0.9243
V_INDEX	1.557052	7.456510	0.208818	0.8347
V_CALL	0.000564	0.001365	0.413014	0.6798
V_PUT	-0.000175	0.001082	-0.161441	0.8718
V_INDEX(-1)	-0.442168	6.556219	-0.067443	0.9463
V_FUTURES(-2)	0.022394	0.386978	0.057870	0.9539
V_CALL(-1)	-6.27E-07	3.65E-05	-0.017185	0.9863

V_PUT(-1)	3.19E-06	2.89E-05	0.110368	0.9122
R-squared	-0.570038	Mean dependent var		0.000484
Adjusted R-squared	-0.597445	S.D. dependent var		0.000219
S.E. of regression	0.000277	Sum squared resid		3.07E-05
F-statistic	27.48656	Durbin-Watson stat		1.999850
Prob(F-statistic)	0.000000	Second-Stage SSR		4.82E-06
J-statistic	0.000000	Instrument rank		8

C. Call Variance/OLS

Dependent Variable: V_CALL				
Method: Least Squares				
Date: 06/08/19 Time: 00:02				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.168739	0.061729	2.733568	0.0065
V_INDEX	1567.336	1620.616	0.967124	0.3341
V_FUTURES	-1481.534	1481.806	-0.999816	0.3180
V_PUT	0.088442	0.023997	3.685571	0.0003
V_INDEX(-1)	-2360.927	1591.418	-1.483537	0.1387
V_FUTURES(-1)	2167.387	1455.745	1.488850	0.1373
V_CALL(-2)	-0.011295	0.049039	-0.230319	0.8180
V_PUT(-1)	-0.003238	0.023989	-0.134963	0.8927
R-squared	0.038417	Mean dependent var		0.143497
Adjusted R-squared	0.021632	S.D. dependent var		0.441263
S.E. of regression	0.436464	Akaike info criterion		1.199145
Sum squared resid	76.39092	Schwarz criterion		1.277653
Log likelihood	-237.2253	Hannan-Quinn criter.		1.230208
F-statistic	2.288688	Durbin-Watson stat		2.000370
Prob(F-statistic)	0.026944			

D.   Put Variance/OLS

Dependent Variable: V_PUT				
Method: Least Squares				
Date: 06/08/19 Time: 00:03				
Sample (adjusted): 3 411				
Included observations: 409 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.10E-15	3.31E-16	-3.316924	0.0010
V_INDEX	-1.25E-10	8.70E-12	-14.33587	0.0000
V_FUTURES	1.13E-10	7.96E-12	14.26642	0.0000

V_PUT	1.000000	1.29E-16	7.77E+15	0.0000
V_INDEX(-1)	1.69E-10	8.55E-12	19.78969	0.0000
V_FUTURES(-1)	-1.54E-10	7.81E-12	-19.77263	0.0000
V_CALL(-1)	4.58E-17	2.63E-16	0.174382	0.8617
V_PUT(-2)	8.65E-17	1.29E-16	0.669334	0.5037
R-squared	1.000000	Mean dependent var		0.215208
Adjusted R-squared	1.000000	S.D. dependent var		0.901853
S.E. of regression	2.34E-15	Sum squared resid		2.20E-27
F-statistic	8.64E+30	Durbin-Watson stat		2.340483
Prob(F-statistic)	0.000000			

Note: Data for the case can be accessed on https://drive.google.com/file/d/1KA23DiOpLxY-7LGvhN5JkZxsBUEGl5e0/view?usp=sharing

Table 5. Price Data of Index, Futures and Call and Put Options

Date	Index	Futures	Call	Put
8-Jan-10	5244.75	5255.483	196.867	140.983
15-Jan-10	5252.2	5261.267	173.8	157.233
22-Jan-10	5036	5020.933	148.55	125.917
29-Jan-10	4882.05	4888.9	169.75	254.817
5-Feb-10	4757.25	4709.15	148.783	378.483
12-Feb-10	4826.85	4826.283	178.433	306.9
19-Feb-10	4844.9	4843.7	171.017	235.533
26-Feb-10	4922.3	4932.683	139.083	211.1
5-Mar-10	5088.7	5088.883	198.3	111.233
12-Mar-10	5137	5143.467	154.233	110.933
19-Mar-10	5262.8	5276.383	93.833	114.55
26-Mar-10	5282	5299.75	149.383	277.183
2-Apr-10	5290.5	5311.417	146.367	137.7
9-Apr-10	5361.75	5367.717	111.783	140.217
16-Apr-10	5262.6	5267.033	118.317	152.483
23-Apr-10	5304.1	5307.4	112.75	108.533
30-Apr-10	5278	5263.133	137.05	176.617
7-May-10	5018.05	5020.35	189.567	172.933
14-May-10	5093.5	5087.383	157.117	167.2
21-May-10	4931.15	4925.333	118.183	195.633
28-May-10	5066.55	5039.333	159.55	214
4-Jun-10	5135.5	5117.867	179.067	163.517
11-Jun-10	5119.35	5114.183	163.75	148.2
18-Jun-10	5262.6	5262.033	91.133	68.65
25-Jun-10	5269.05	5285.133	164.7	113.333
2-Jul-10	5237.1	5253.5	209.467	150.283
9-Jul-10	5352.45	5356.417	120.517	164.433

16-Jul-10	5393.9	5401.867	127.383	131.1
23-Jul-10	5449.1	5448.817	141.317	92.533
30-Jul-10	5367.6	5378.783	141.683	162.45
6-Aug-10	5439.25	5446.2	151.95	112.033
13-Aug-10	5452.1	5461.5	86.917	130.983
20-Aug-10	5530.65	5530.033	111.833	87.167
27-Aug-10	5408.7	5419.617	166.717	153.65
3-Sep-10	5479.4	5488.683	117.417	132.633
10-Sep-10	5640.05	5635.85	135.017	100.5
17-Sep-10	5884.95	5917.95	134.867	113.6
24-Sep-10	6018.3	6046.117	154.7	106.967
1-Oct-10	6143.4	6186.333	238.567	151.1
8-Oct-10	6103.45	6148.617	207.35	160.7
15-Oct-10	6062.65	6111.317	172.917	160.217
22-Oct-10	6066.05	6113.25	149.633	135.817
29-Oct-10	6017.7	6062.917	221.433	164.633
5-Nov-10	6312.45	6348.283	197.683	146.85
12-Nov-10	6071.65	6123.617	174.383	153.25
19-Nov-10	5890.3	5918.55	100.367	185.417
26-Nov-10	5751.95	5797.867	101.55	296.783
3-Dec-10	5992.8	6037.6	176.517	141.75
10-Dec-10	5857.35	5902.583	113.217	208.717
17-Dec-10	5948.75	5990.933	135.583	144.4
24-Dec-10	6011.6	6063.1	146.167	86.25
31-Dec-10	6134.5	6186.983	204.733	114.767
7-Jan-11	5904.6	5941.85	187.567	151.617
14-Jan-11	5654.55	5677.633	157.85	187.05
21-Jan-11	5696.5	5724.733	145.65	124.617
28-Jan-11	5512.15	5555.517	221.333	176.7
4-Feb-11	5395.75	5404.833	176.783	183.067
11-Feb-11	5310	5334.883	166.167	139.25
18-Feb-11	5458.95	5475.433	124.733	151.933
25-Feb-11	5303.55	5334.233	223.167	199.267
4-Mar-11	5538.75	5552.917	202.3	151.6
11-Mar-11	5445.45	5481.05	214.633	140.067
18-Mar-11	5373.7	5412.65	171.033	163.5
25-Mar-11	5654.25	5700.117	115.017	113.683
1-Apr-11	5826.05	5877.817	216.5	144.433
8-Apr-11	5842	5868.983	198.6	135.85
15-Apr-11	5824.55	5851.85	180.017	130.65
22-Apr-11	5884.7	5923.25	139.55	118.3
29-Apr-11	5749.5	5767.217	208.667	150.833
6-May-11	5551.45	**5568.183**	137.517	172.05

13-May-11	5544.75	5573.633	177.233	111.867
20-May-11	5486.35	5494.5	109.7	117.1
27-May-11	5476.1	5476.217	140.283	165.717
3-Jun-11	5516.75	5533.617	159.433	128.683
10-Jun-11	5485.8	5497.183	130.833	136.167
17-Jun-11	5366.4	5395.867	126.5	133.283
24-Jun-11	5471.25	5497.433	106.3	111.217
1-Jul-11	5627.2	5655.417	182.283	128.533
8-Jul-11	5660.65	5690.583	134.817	146.2
15-Jul-11	5581.1	5604.683	134.933	132.167
22-Jul-11	5633.95	5664.317	143.967	81.6
29-Jul-11	5482	5504.883	158.3	155.2
5-Aug-11	5211.25	5226.867	181.033	157.167
12-Aug-11	5072.95	5091.183	160.717	171.55
19-Aug-11	4845.65	4857.85	182.55	131.35
26-Aug-11	4747.8	4757.75	237.517	190.633
2-Sep-11	5040	5046.167	193.783	150.933
9-Sep-11	5059.45	5065.2	149.667	186.033
16-Sep-11	5084.25	5101.817	158.9	161.4
23-Sep-11	4867.75	4885.367	160.267	179.267
30-Sep-11	4943.25	4948.417	245.717	202.717
7-Oct-11	4888.05	4911.6	214.983	206.283
14-Oct-11	5132.3	5159.683	189.15	130.783
21-Oct-11	5049.95	5072.85	182.717	113.367
28-Oct-11	5360.7	5405.367	160.967	156.8
4-Nov-11	5284.2	5338.917	183.717	146.067
11-Nov-11	5168.85	5215.033	163.467	151.267
18-Nov-11	4905.8	4940.083	165.283	128.85
25-Nov-11	4710.05	4730.533	215.017	190.25
2-Dec-11	5050.15	5098.083	218.883	123.05
9-Dec-11	4866.7	4908.15	185.65	181.05
16-Dec-11	4651.6	4664.5	141.267	180.817
23-Dec-11	4714	4739.617	152.2	116.517
30-Dec-11	4624.3	4653.6	205.2	156.533
6-Jan-12	4746.9	4790.633	211.5	126.5
13-Jan-12	4866	4898.767	140.267	142.817
20-Jan-12	5048.6	5074.733	163.95	93
27-Jan-12	5204.7	5236.533	183.283	151.15
3-Feb-12	5325.85	5372.2	209.95	140.167
10-Feb-12	5381.6	5425.517	165.717	142.367
17-Feb-12	5564.3	5621.7	152.333	132.6
24-Feb-12	5429.3	5516.733	265.217	154.35
2-Mar-12	5359.4	5423.667	220.267	199.25

9-Mar-12	5333.55	5397.217	231.883	140.35
16-Mar-12	5317.9	5380.95	193.817	117.067
23-Mar-12	5278.2	5324.5	141.383	121.55
30-Mar-12	5295.55	5361.417	203.567	146.817
6-Apr-12	5322.9	5372.683	194.4	127.483
13-Apr-12	5207.45	5248.567	172.3	128.4
20-Apr-12	5290.85	5331.167	135.433	107.517
27-Apr-12	5209	5226.433	166.883	142.683
4-May-12	5086.85	5116.7	159.417	145.967
11-May-12	4928.9	4947.85	115.967	170.8
18-May-12	4891.45	4905.633	133.267	131.05
25-May-12	4920.4	4931.6	136.767	109.033
1-Jun-12	4841.6	4843.75	197.067	157
8-Jun-12	5068.35	5078.7	136.55	156.667
15-Jun-12	5139.05	5170.85	187.883	120.25
22-Jun-12	5146.05	5173.05	151	81.6
29-Jun-12	5278.9	5321.117	155.117	135.15
6-Jul-12	5316.95	5353.267	160.1	107.683
13-Jul-12	5227.25	5265.517	156.483	93.867
20-Jul-12	5205.1	5240.467	118.867	81.233
27-Jul-12	5099.85	5149.583	164.283	120.7
3-Aug-12	5215.7	5266.633	162.75	98.783
10-Aug-12	5320.4	5369.4	149.617	85.033
17-Aug-12	5366.3	5408.317	102.333	95.433
24-Aug-12	5386.7	5429.483	104.667	77.217
31-Aug-12	5258.5	5320.517	143.367	123.633
7-Sep-12	5358.7	5386.5	102.033	117.583
14-Sep-12	5577.65	5610.867	105.367	91.9
21-Sep-12	5691.15	5731.65	128.583	94.767
28-Sep-12	5703.3	5756.967	165.017	109.067
5-Oct-12	5746.95	5807.75	191.767	85.9
12-Oct-12	5676.05	5717.933	126.2	109.05
19-Oct-12	5684.25	5719.833	105.3	84.5
26-Oct-12	5664.3	5728.117	143.967	80.317
2-Nov-12	5697.7	5769.583	153.217	85.55
9-Nov-12	5686.25	5752.817	136.5	83.183
16-Nov-12	5574.05	5614.8	110.25	97.35
23-Nov-12	5626.6	5665.1	118.95	56.333
30-Nov-12	5879.85	5941.117	141.433	103.05
7-Dec-12	5907.4	5976.967	157.183	84.633
14-Dec-12	5879.6	5949.383	127.417	78.017
21-Dec-12	5847.7	5898.7	152.633	56.617
28-Dec-12	5908.35	5987.8	174.5	89.133

4-Jan-13	6016.15	6083.217	165.25	85.483
11-Jan-13	5951.3	6015.983	115.85	99.617
18-Jan-13	6064.4	6110.25	104.883	96.367
25-Jan-13	6074.65	6109.5	98.367	89.567
1-Feb-13	5998.9	6066.65	153.55	90.583
8-Feb-13	5903.5	5951.5	141.217	91.45
15-Feb-13	5887.4	5923.983	116.15	92.683
22-Feb-13	5850.3	5885.583	150.3	66.967
1-Mar-13	5719.7	5758.967	143.883	87.883
8-Mar-13	5945.7	5994.7	156.117	67.95
15-Mar-13	5872.6	5926.1	114.1	93.333
22-Mar-13	5651.35	5700.517	92.567	94.3
29-Mar-13	5682.55	5707.867	81.483	74.967
5-Apr-13	5553.25	5589.367	112.267	125.233
12-Apr-13	5528.55	5550.217	138.083	92.8
19-Apr-13	5783.1	5798.1	92.933	97.833
26-Apr-13	5871.45	5900.067	127.2	127.883
3-May-13	5944	5958.183	158.5	103.583
10-May-13	6107.25	6114.05	134.883	121.883
17-May-13	6187.3	6205	125.9	117.733
24-May-13	5983.55	5999.683	106.433	109.8
31-May-13	5985.95	6017.183	146.533	135.7
7-Jun-13	5881	5915.4	137.75	128.817
14-Jun-13	5808.4	5824.117	136.767	115.933
21-Jun-13	5667.65	5680.467	102.017	123.133
28-Jun-13	5842.2	5861.917	182.617	122.683
5-Jul-13	5867.9	5897.217	141.95	147.267
12-Jul-13	6009	6028.2	146.767	123.45
19-Jul-13	6029.2	6075.55	160.4	89.783
26-Jul-13	5886.2	5954.75	187.717	137.717
2-Aug-13	5677.9	5734.5	185.217	156.233
9-Aug-13	5565.65	5620.267	163.667	147.3
16-Aug-13	5507.85	5538	172.767	142.083
23-Aug-13	5471.75	5490.7	135.567	149.933
30-Aug-13	5471.8	5483.85	195.8	84
6-Sep-13	5680.4	5723.433	213.517	195.517
13-Sep-13	5850.6	5914.3	205.5	267.917
20-Sep-13	6012.1	6081.617	204.033	125.783
27-Sep-13	5833.2	5926.467	288	162.317
4-Oct-13	5907.3	5989.567	263.733	177.8
11-Oct-13	6096.2	6172.883	229.2	160.8
18-Oct-13	6189.35	6256.4	172.5	121.383
25-Oct-13	6144.9	6199.683	187.767	6.133

1-Nov-13	6307.2	6399.8	231.067	133.917
8-Nov-13	6140.75	6234.867	236.767	110.65
15-Nov-13	6056.15	6139.483	186.233	129.833
22-Nov-13	5995.45	6067.367	161.1	100.2
29-Nov-13	6176.1	6275.083	220.333	155.967
6-Dec-13	6259.9	6353.283	222.417	149.517
13-Dec-13	6168.4	6247.883	165.65	120.433
20-Dec-13	6274.25	6337.817	130.767	94.167
27-Dec-13	6313.8	6411.667	213.933	107.15
3-Jan-14	6211.15	6291.483	199.267	113.233
10-Jan-14	6171.45	6213.283	136.717	126.617
17-Jan-14	6261.65	6298.083	182.8	93.6
24-Jan-14	6266.75	6311.65	153.3	81.5
31-Jan-14	6089.5	6147.967	169.533	125
7-Feb-14	6063.2	6108.183	148.517	143.9
14-Feb-14	6048.35	6092.317	147.667	108.433
21-Feb-14	6155.45	6199	119.8	75.85
28-Feb-14	6276.95	6322.867	196.483	176.667
7-Mar-14	6526.65	6583.317	225.967	143.883
14-Mar-14	6504.2	6578.833	213.2	132.85
21-Mar-14	6494.9	6558.05	183.467	124.2
28-Mar-14	6695.9	6756.833	263.7	253.467
4-Apr-14	6694.35	6775.233	266.683	190.333
11-Apr-14	6776.3	6841.483	259.75	218.483
18-Apr-14	6779.4	6835.467	236.6	199.317
25-Apr-14	6782.75	6851.833	303.95	255.033
2-May-14	6694.8	6752.333	316.5	258.133
9-May-14	6858.8	6906.8	308.033	222.867
16-May-14	7203	7268.367	235.033	168.867
23-May-14	7367.1	7407.75	141.333	129.467
30-May-14	7229.95	7269.033	238.967	137.9
6-Jun-14	7583.4	7624.583	173.7	210.267
13-Jun-14	7542.1	7595.683	215.017	122.683
20-Jun-14	7511.45	7560.083	184.017	125.617
27-Jun-14	7508.8	7580.417	236.75	161.967
4-Jul-14	7751.6	7823.6	183.4	195.117
11-Jul-14	7459.6	7520.983	234.25	111.083
18-Jul-14	7663.9	7706.783	143	133.25
25-Jul-14	7790.45	7819.75	123.617	103.3
1-Aug-14	7602.6	7658.633	194.583	134.3
8-Aug-14	7568.55	7630.533	161.317	135.017
15-Aug-14	7791.7	7837.567	145.333	110.35
22-Aug-14	7913.2	7962.233	145.733	86.767

29-Aug-14	7954.35	7986.667	98.45	89.2
5-Sep-14	8086.85	8158.05	174.467	121.883
12-Sep-14	8105.5	8180.567	178.967	97.617
19-Sep-14	8121.45	8179.95	156.45	78.683
26-Sep-14	7968.85	8081.267	212.933	135.85
3-Oct-14	7945.55	8032.4	250.633	136.9
10-Oct-14	7859.95	7936	257.583	101.583
17-Oct-14	7779.7	7826.767	188.883	129.783
24-Oct-14	8014.55	8068.75	153.75	86.617
31-Oct-14	8322.2	8402.267	214.75	114.083
7-Nov-14	8337	8436.333	228.3	97.417
14-Nov-14	8389.9	8465.517	165.683	102.783
21-Nov-14	8477.35	8543.217	132.55	91.95
28-Nov-14	8588.25	8688.55	207.367	122.283
5-Dec-14	8538.3	8634.417	221.383	89.6
12-Dec-14	8224.1	8333.15	217.7	89.55
19-Dec-14	8225.2	8302.3	186.517	87.733
26-Dec-14	8200.7	8324.1	263.467	148.25
2-Jan-15	8395.45	8508.917	237.683	130.9
9-Jan-15	8284.5	8364.933	211.783	151.133
16-Jan-15	8513.8	8583	223.617	143.15
23-Jan-15	8835.6	8896.833	223.383	128.867
30-Jan-15	8808.9	8931.133	319.9	193.283
6-Feb-15	8661.05	8774.667	322.133	235.95
13-Feb-15	8805.5	8901.967	264.467	162.217
20-Feb-15	8833.6	8911.45	253.267	140.317
27-Feb-15	8901.85	8944.417	238.317	230.7
6-Mar-15	8937.75	9046.467	264.55	124.683
13-Mar-15	8647.75	8735.683	374.883	131.917
20-Mar-15	8570.9	8666.117	175.05	115.683
27-Mar-15	8341.4	8484.267	391.467	136.617
3-Apr-15	8586.25	8676.633	217.367	146.383
10-Apr-15	8780.35	8852.083	188.717	139.883
17-Apr-15	8606	8684.55	201.133	120.833
24-Apr-15	8305.25	8367.683	199.233	139.283
5-Jun-15	8114.7	8155.633	233.033	173.517
12-Jun-15	7982.9	8016.317	177.633	164.917
19-Jun-15	8224.95	8264.55	168.383	105.5
26-Jun-15	8381.1	8417.767	200.15	186.933
3-Jul-15	8484.9	8522.45	198.533	176.467
10-Jul-15	8360.55	8423.867	317.683	418.4
17-Jul-15	8609.85	8661.567	181.267	122.55
24-Jul-15	8521.55	8574.767	174.45	101.633

31-Jul-15	8532.85	8609.3	240.7	136.583
7-Aug-15	8564.6	8633.35	245.783	213.183
14-Aug-15	8518.55	8580.283	202.5	126.417
21-Aug-15	8299.95	8347.667	171.017	127.05
28-Aug-15	8001.95	8064.917	272.75	216.55
4-Sep-15	7655.05	7705.933	628.383	169.85
11-Sep-15	7789.3	7822.283	243.533	220
18-Sep-15	7981.9	8018.2	166.467	152
25-Sep-15	7868.5	7898.433	285.9	183.633
2-Oct-15	7950.9	8013.617	400.8	315.733
9-Oct-15	8189.7	8246.867	219.367	177.467
16-Oct-15	8238.15	8299.15	213.95	117.933
23-Oct-15	8295.45	8342.517	160.25	117.833
30-Oct-15	8065.8	8134.967	318.2	243.567
6-Nov-15	7954.3	8021.55	352.417	214.95
13-Nov-15	7762.25	7817.483	413.967	148.917
20-Nov-15	7856.55	7890.983	246.667	95.267
27-Nov-15	7942.7	8010.467	298.167	162.317
4-Dec-15	7781.9	7856.9	207.467	153.1
11-Dec-15	7610.45	7664.7	199.417	139.283
18-Dec-15	7761.95	7823.15	363.283	90.183
25-Dec-15	7861.05	7901.867	181.967	98.233
1-Jan-16	7963.2	8006.6	241.367	157.333
8-Jan-16	7601.35	7630.617	190.233	165.55
15-Jan-16	7437.8	7469.05	213	148.283
22-Jan-16	7422.45	7443.083	171.983	132.65
29-Jan-16	7563.55	7584.417	334.917	145.283
5-Feb-16	7489.1	7540.167	200.467	167.317
12-Feb-16	6980.95	7013.55	210.783	204.1
19-Feb-16	7210.75	7236.017	168.817	135.983
26-Feb-16	7029.75	7081.083	253.05	178.8
4-Mar-16	7485.35	7484.517	169.933	186.467
11-Mar-16	7510.2	7543.467	183	143.067
18-Mar-16	7604.35	7636.567	158.8	125.667
25-Mar-16	7716.5	7772.683	168.933	100.983
1-Apr-16	7713.05	7772.783	225.933	155.183
8-Apr-16	7555.2	7603.033	271.583	291.267
15-Apr-16	7850.45	7895	208.95	403.75
22-Apr-16	7899.3	7941.883	159.05	117.8
29-Apr-16	7849.8	7909.55	295.233	219.233
6-May-16	7733.45	7774.633	211.4	141.417
13-May-16	7814.9	7845.133	181.417	138.067
20-May-16	7749.7	7773.317	220.467	134.483

27-May-16	8156.65	8195.017	246.917	270.367
3-Jun-16	8220.8	8264.35	204.117	143.717
10-Jun-16	8170.05	8224.1	176.083	153.183
17-Jun-16	8170.2	8201.917	162.417	158.717
24-Jun-16	8088.6	8116.85	160.9	143.117
1-Jul-16	8328.35	8389.533	231.7	144.933
8-Jul-16	8323.2	8373.817	205.7	134.933
15-Jul-16	8541.4	8592.017	169.55	312.75
22-Jul-16	8541.2	8593.883	151.233	174.333
29-Jul-16	8638.5	8731.367	220.15	222.833
5-Aug-16	8683.15	8752.25	195.45	144.483
12-Aug-16	8672.15	8722.767	158.633	137.467
19-Aug-16	8666.9	8721.417	164.283	109.9
26-Aug-16	8572.55	8663.967	210.233	147.2
2-Sep-16	8809.65	8880.117	202.167	125.1
9-Sep-16	8866.7	8944.067	165.817	194.617
16-Sep-16	8779.85	8848.917	174.383	23.567
23-Sep-16	8831.55	8884.867	171.583	87.083
30-Sep-16	8611.15	8683.417	254.817	172.35
7-Oct-16	8697.6	8768.55	207.167	141.25
14-Oct-16	8583.4	8649.317	177.983	132.133
21-Oct-16	8693.05	8746.817	151.183	106.383
28-Oct-16	8638	8715.867	245.383	131.983
4-Nov-16	8433.75	8505.733	249.367	135.233
11-Nov-16	8296.3	8377.567	206.25	135.383
18-Nov-16	8074.1	8117.217	160.35	143.517
25-Nov-16	8114.3	8158.033	225.85	179.233
2-Dec-16	8086.8	8143.883	214.033	174.117
9-Dec-16	8261.75	8308.233	309.35	186.883
16-Dec-16	8139.45	8181.033	193.667	117.033
23-Dec-16	7985.75	8028.133	139.033	112.833
30-Dec-16	8185.8	8211.767	185.467	176.833
6-Jan-17	8243.8	8294.5	158.867	256.067
13-Jan-17	8400.35	8441.367	163.567	124.233
20-Jan-17	8349.35	8387.5	146.9	168.233
27-Jan-17	8641.25	8699.667	190.75	288.167
3-Feb-17	8740.95	8781.567	145.933	174.15
10-Feb-17	8793.55	8841.2	161.317	120.8
17-Feb-17	8821.7	8859.5	157.217	101.95
24-Feb-17	8939.5	8962.95	101.933	169.833
3-Mar-17	8897.55	8948.917	189	143.483
10-Mar-17	8934.55	8985.75	187.083	207.683
17-Mar-17	9160.05	9198.95	107.183	137

24-Mar-17	9108	9146.967	141.1	95.767
31-Mar-17	9173.75	9214.617	173.833	157.717
7-Apr-17	9198.3	9232.017	161.767	132.517
14-Apr-17	9150.8	9204.233	192.417	143.017
21-Apr-17	9119.4	9143.833	134.85	93.883
28-Apr-17	9304.05	9334.767	161.7	126.65
5-May-17	9285.3	9321.333	153.933	133.033
12-May-17	9400.9	9421.267	128.8	109.933
19-May-17	9427.9	9451.417	140.367	91.767
26-May-17	9595.1	9591.3	169.667	151.3
2-Jun-17	9653.5	9674.217	158.067	199.433
9-Jun-17	9668.25	9703.033	162.1	190.317
16-Jun-17	9588.05	9619.883	133.7	112.383
23-Jun-17	9574.95	9613.5	116.817	102
30-Jun-17	9520.9	9547.717	182.6	140.633
7-Jul-17	9665.8	9698.033	169.767	152.133
14-Jul-17	9886.35	9928.967	143.467	117.45
21-Jul-17	9915.25	9944.733	143.633	100.633
28-Jul-17	10014.5	10075	212.367	144.35
4-Aug-17	10066.4	10141.317	144.083	210.083
11-Aug-17	9710.8	9773.5	212.783	143.533
18-Aug-17	9837.4	9884.583	221.467	104.5
25-Aug-17	9857.05	9906.217	209.5	72.967
1-Sep-17	9974.4	10036.85	182.917	147.217
8-Sep-17	9934.8	9981.183	248.9	132.017
15-Sep-17	10085.4	10132.083	4.933	898.217
22-Sep-17	9964.4	10018.3	242.65	120.6
29-Sep-17	9788.6	9836.8	193.2	163.467
6-Oct-17	9979.7	10031.633	167.367	140.033
13-Oct-17	10167.45	10224.167	131.067	184.65
20-Oct-17	10146.55	10174.917	130.833	196.733
27-Oct-17	10323.05	10392	236.5	148.3
3-Nov-17	10452.5	10521.117	160.383	548.8
10-Nov-17	10321.75	10367.117	203.417	137.517
17-Nov-17	10283.6	10344.85	172.567	128.1
24-Nov-17	10389.7	10443.967	156.233	113.9
1-Dec-17	10121.8	10187.333	246.733	129.8
8-Dec-17	10265.65	10322.5	269.217	160.083
15-Dec-17	10333.25	10391.8	185.833	160.367
22-Dec-17	10493	10542.967	146.117	107
29-Dec-17	10530.7	10578.783	246.483	175.667

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