

# Seasonality Effect in Solar Power and Battery Sector

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## ABSTRACT

In this paper, the concept of Seasonality has been understood with the help of Chow Tests. For the purpose of the research, two sectors that are affected by this phenomenon are chosen with three companies under each that are analysed for Seasonality testing. From the Solar Power industry, WelspunCorp Ltd., Websol Energy Systems Ltd., and Moser Baer, and Amara Raja Batteries Ltd., Exide India Ltd., and HBL Power Ltd. has been chosen from the Battery sector. These companies are chosen in the order of their contribution of market capitalisation of their respective sectors. The NSE India website has been referred to for extracting the stock prices of the company for the analysis.

Based on various prior researches, Seasonality has been observed as a vital factor for the investors to consider at the time of making their investment decision as this concept helps predict the variations and volatility of the stocks of companies.

## 1. Introduction

The Stock Market of any country is a fragile body that is dependent on many factors, one such latent factor is the seasonality of events. Seasonality refers to particular time frames when the stocks of particular companies or industries, are subject to changes by recurring tendencies. These tendencies may be due to recurrences of particular events that may result in patterns being formed over a period of time which help investors make decisions. The valuation of the stock prices depend on such patterns that include a variety of factors such as weather conditions, financial calendar events, holidays and festivals, momentous events, and many more reasons. Two industries that are also affected by this phenomenon are the solar and the battery sectors. The solar power industry is a fast growing industry especially in India, with all the issues regarding sustainability this energy source is picking up. This sector is hit the hardest during the months of January and December, whereas they flourish during the monsoon and summer months. This thus, would lead to patterns being formed in the stock market due to the effect of seasonality. Another sector that has been chosen is the battery industry that include companies that manufacture and sell automobile batteries, UPS batteries and other high duty usage batteries. The tendency in this case would be more related towards weather conditions as they usually affect the life and usage of the same.

## 2. Review of literature

A. **(Dhanu, Sudarvel, & Velmurugan, 2017).** *Seasonality effect in Indian stock market with reference to BSE SENSEX index. Journal of Advanced Research in Dynamical and Control Systems.* In the following paper, in spite of being the most efficient markets in information transfer, the weakness of Stock Markets lies in the inability regarding the prediction of the stock prices and the variation of returns based on the various prices data of the stocks. Efficient Market Hypothesis (EMH) was conducted by them in various studies that show that the behaviour of the stocks were at random. However,

based on many more researches conducted, evidence was found against the EMH studies, i.e., the systematic variations in the return that the stocks yield, thus, they concluded that a few important abnormalities are Day of the week effect, Semi Monthly effect and the Seasonal effect. The Seasonal effect on the prices and returns of the stocks opposes the EMH and elaborates on efficient market.

- B. **(Sarma, 2004).** *Stock Market Seasonality in an Emerging Market. Vikalpa, Volume 29.* In the following paper, daily mean index values were used to generate the daily return, this was done by them so that they could refute and prove assumptions of any prior studies. They said that by if the closing values were considered, then the trading traditionally is done at the closing values only. They used the Kruskal-Wallis test using the 'H' statistic. This was used to test the seasonality in the Indian Stock returns. Their null hypothesis dictated that the mean daily returns across the weekdays remained constant without any change. The conclusions of their study is as follows, the Indian Stock Market do portray seasonality in their return patterns. They also found that the monday-tuesday, monday-friday, and wednesday-friday have positive deviations for all the indices. This was beneficial to infer that this strategy worked best in the case of SENSEX, whereas for the NATEX and BSE200 a passive strategy such as buy and hold was more efficient
- C. **(Nageswari & Selvam, 2011).** *An Empirical Study on Seasonal Analysis in the Indian Stock Market. IJMBS Vol. 1, Issue 4, Oct-Dec 2011.* This research elaborates the effect of seasonality and the regularity and irregularity of the fluctuations in Time Series which takes place within the span of a year. Besides the seasonality testing, the study also examines the effect of traditions and customs on the economic variables. It was observed that systematic order at certain days of the week or week of the

month or even months of the year play an important, focusing on the monthly patterns mainly.

D. **(Dua & Kumawat, 2005). Modelling and Forecasting Seasonality in Indian Macroeconomic Time Series. CDE July 2005.** This paper suggests that narrow money and consumer price index do exhibit non stationary seasonality, and that seasonality is a vital consideration for a variety of macroeconomic time series, usually affecting various other related factors along with it. This paper concludes that the two most effective models to determine the movements in the annual time series for seasonality are the seasonal integration model and the periodic model.

E. **(Pathak, 2013). Stock Market Seasonality: A Study of the Indian Stock Market (NSE). PARIPEX - INDIAN JOURNAL OF RESEARCH.** A large number of empirical studies on the concept of calendar effects have been studied in this paper which show the variation of returns from average return in the specific calendar periods. The calendar effect also creates irregularity in the returns of the stocks that create phenomenon like "Day of the Week", the "Month of the Year", holidays which are studied along with cases of the Monday effect and the January effect. These are said to create "efficient market hypothesis". The study also tells that stock returns do not rely much on the time factor and short term seasonal variation in stock returns is not observed.

### 3. Research Design

#### Scope of study

We have selected the following equity stocks from the below mentioned industries, the reason for selecting these industries are that they are lesser focused on sectors, with both these sectors having immense growth potential considering the issues regarding sustainability and energy in our environment.

SERIAL NUMBER	SOLAR SECTOR STOCKS	BATTERY SECTOR STOCKS
1.	Welspun Corp. Ltd.	Amara Raja Batteries Ltd.
2.	Websol Energy System Ltd.	Exide Ltd.
3.	Moser Baer	HBL Power Ltd.

#### Statement of problem

Both the above mentioned sectors, i.e., the Solar Energy sector and the battery sectors do not have much prior research conducted upon it, especially in India. A study upon the volatility and seasonality of the selected companies in these sectors has been conducted to derive whether there lies any correlation of the seasonal variation on the stock prices of the companies.

#### Objective of study

To establish a relationship between the seasonality and the stock prices of the companies selected using the Chow Test method of analysis.

#### Source of data

Secondary source of data has been collected and analyzed for the purpose of this research paper.

Historical stock data has been collected from the following sources:

- <https://www.nseindia.com>
- <https://www.moneycontrol.com>

#### Hypothesis

H0: There lies no significant relationship between the stock prices and their seasonal impact.

H1: There lies a significant relationship between the stock prices and their seasonal impact.

#### Limitations of the study

- The study focuses only on two industries.
- Research is based on the averages of the monthly share prices, which will reflect only an overall performance and not a detailed one.
- The historical data used to conduct the research is merely for 24 months.
- Top three companies, according to market capitalization, have been chosen in the respective sectors. This may not reflect the condition of the industry as a whole.

#### Period of Study

The study was conducted using data for the companies between the time periods of 1 April 2016 till 31 March 2018.

#### Tools Used for Analysis

In this study, to test the seasonality of returns the FCAL and PVAL values are calculated as follows:

##### FCAL calculation (F critical Value):

Three cases are taken where in the first case a single regression line is calculated and expressed. Following this, a structural break is taken for the data set, and two separate models are then taken. These models represent two different time periods on the basis of the structural break.

##### PVAL calculation (P distribution function):

PVAL helps to calculate the degree of diversity. It helps to show the relation between the F critical value; that is derived from the sum of squares of the regressions, and degrees of freedom. If the PVAL is greater than or equal to 0.05, then there lies no significant relationship between the dependent and independent variables, and a null hypothesis can be inferred. On the other hand, if the PVAL is lesser than 0.05, there does lie a significant relationship, and therefore alternative hypothesis, examining the various circumstances, can be obtained.

#### 4. Method of Analysis

##### **SOLAR POWER SECTOR**

##### **Welspun Corp Ltd.**

###### ANOVA – SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	14799.63	14799.63	44.89391	9.8E-07
Residual	22	7252.471	329.6578		
Total	23	22052.1			

###### ANOVA – MODEL 1 (first 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	391.4519	391.4519	5.361181	0.045828
Residual	9	657.1437	73.01597		
Total	10	1048.596			

###### ANOVA – MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	9193.081	9193.081	96.95855	8.62E-07
Residual	11	1042.96	94.81454		
Total	12	10236.04			

FCAL :3.432998

PVAL :0.052272

Since, the PVAL is just slightly more than 0.05, it indicates that there is no significant relationship between seasonality and the share prices of the indices. Thus, a Null Hypothesis (H0) is accepted.

##### **Websol Energy System Ltd.**

###### ANOVA – SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	19034.26	19034.26	49.47601	4.66E-07
Residual	22	8463.772	384.7169		
Total	23	27498.03			

###### ANOVA – MODEL 1 (first 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.431932	2.431932	0.056499	0.81744
Residual	9	387.3921	43.04357		
Total	10	389.824			

###### ANOVA – MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	606.4009	606.4009	1.434648	0.25618
Residual	11	4649.511	422.6829		
Total	12	5255.912			

FCAL :9.678902

PVAL :0.001148

Since, the PVAL is just lesser than 0.05, it indicates that there lies a significant relationship between seasonality and the share prices of the indices. Thus, an Alternative Hypothesis (H1) is accepted.

##### **Moser Baer**

###### ANOVA – SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	56.56837	56.56837	145.9274	3.5E-11
Residual	22	8.528243	0.387647		
Total	23	65.09661			

## ANOVA – MODEL 1 (first 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.34543	2.34543	12.54011	0.006302
Residual	9	1.683308	0.187034		
Total	10	4.028739			

## ANOVA – MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	5.760903	5.760903	11.41241	0.006162
Residual	11	5.552722	0.504793		
Total	12	11.31363			

FCAL 8.225923

PVAL :0.002472

Since, the PVAL is just lesser than 0.05, it indicates that there lies a significant relationship between seasonality and the share prices of the indices. Thus, an Alternative Hypothesis (H1) is accepted.

**BATTERY SECTOR****Amara Raja Batteries Ltd.**

## ANOVA- SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1019196	1019196	57.35608	1.45E-07
Residual	22	390931.8	17769.63		
Total	23	1410128			

## ANOVA- MODEL 1 (First 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	303.114	303.114	5.855988	0.038616
Residual	9	465.8523	51.76137		
Total	10	768.9663			

## ANOVA- MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	750046.7	750046.7	108.3995	4.93E-07
Residual	11	76112.12	6919.284		
Total	12	826158.8			

FCAL: 2.6370

PVAL: 0.0963

Since, the PVAL is just slightly more than 0.05, it indicates that there is no significant relationship between seasonality and the share prices of the indices. Thus, a Null Hypothesis (H0) is accepted.

**Exide India Ltd.**

## ANOVA- SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	8685.115	8685.115	32.40791	1E-05
Residual	22	5895.862	267.9937		
Total	23	14580.98			

## ANOVA- MODEL 1 (First 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	3060.847	3060.847	25.88738	0.000656
Residual	9	1064.133	118.237		
Total	10	4124.98			

ANOVA- MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	321.0964	321.0964	4.134952	0.066852
Residual	11	854.1962	77.6542		
Total	12	1175.293			

FCAL: 4.0610

PVAL: 0.0331

Since, the PVAL is just lesser than 0.05, it indicates that there lies a significant relationship between seasonality and the share prices of the indices. Thus, an Alternative Hypothesis (H1) is accepted.

#### HBL Power Ltd.

ANOVA- SINGLE REGRESSION LINE

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2011.63	2011.63	67.63091	3.72E-08
Residual	22	654.3733	29.74424		
Total	23	2666.004			

ANOVA- MODEL 1 (First 11 months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	41.80644	41.80644	7.521501	0.022753
Residual	9	50.02432	5.558257		
Total	10	91.83076			

ANOVA- MODEL 2 (remaining months)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	515.5043	515.5043	10.78674	0.007278
Residual	11	525.6962	47.79057		
Total	12	1041.201			

FCAL: 7.0824

PVAL: 0.0047

Since, the PVAL is just lesser than 0.05, it indicates that there lies a significant relationship between seasonality and the share prices of the indices. Thus, an Alternative Hypothesis (H1) is accepted.

#### 5. Analysis of Result and Interpretation

From the above data obtained from conducting Chow Tests, we infer that in the case of both, the Solar energy sector and the Battery sector, there lies a significant relationship between the seasonality and the stock prices of the selected companies.

#### 6. Conclusion

Due to certain events taking place in the market that affect these sectors, it is observed that the phenomenon of seasonality has impacted the stock prices of these companies resulting in patterns being formed over a period of time. These patterns are observed using the Chow Test and represented

using the Anova tables. Investors can interpret these patterns and accordingly make investing decisions for the future. The existence of seasonality indicates that the share prices are dependent on factors such as weather and day light hours in the case of solar energy sector, whereas factors like monsoons and temperature may impact the share prices in the battery sector. We also notice that in India there are not many listed companies for both the above mentioned sectors, however these industries are growing at a rapid pace. Thus, at times like these it is vital for investors to understand the effect of seasonality in such stocks.

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