

# **A STUDY ON THE POWER SECTOR STOCKS WITH NIFTY INDEX USING GRANGER CAUSALITY TEST**

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**Abstract:** The study is conducted to understand the risks arising in the securities market sector in Power Sector Companies. The study examines causality between the daily returns of stocks and the daily returns of nifty and finds the relationship between the power sector stocks with the nifty index. The study is analytical and is based on secondary data information. The data for the study consisted of the daily closing prices for a sample of ten power stocks listed on the NSE and the nifty over the period of seven years, from January 1, 2006 through to November 30, 2013. The sample stocks were selected by simple random sampling from the NSE-listed power sector stocks. In the study Granger Causality test is used on the selected industrial securities with the Nifty index using their returns and analyzes the risk involved in investing each company. For most of the stocks, there was bi-directional causality exists from the daily returns of both index and the selected stocks. For KSK and Jai Prakash hydro, there was only uni-directional causality existence, i.e. the feedback from the nifty did not have much impact on these stocks. The study reports that, though market returns is a necessary factor in explaining individual stock returns, it cannot be the only explanatory factor involved. Thus, the security line as represented by the regression equation is inadequate; other factors would need to be introduced in order to explain stock returns more completely.

**Key Words:** securities, Index, Granger Causality Test, Returns, Risk.

## **1. INTRODUCTION**

Power is considered as a major requirement in an economy. It is the source, which the economy uses to develop itself. India in terms of electricity generation capacity is 5<sup>th</sup> in the world. Public sector companies and State Electricity Boards (SEBs) are having the majority in generation, transmission and distribution capacities. Private sector participation is increasing especially in distribution and generation.

Electricity production in India witnessed a 4% growth over the previous fiscal FY 13 standing at 911.6 terra watt hour (TWh). In 2010-2014, the annual installed capacity will grow at a compound annual growth rate (CAGR) of around 49.5% to reach 1,500 megawatt (MW).<sup>1</sup> The electricity production has increased at a CAGR of 5.5 % over

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<sup>1</sup> RNCOS research report titled, 'Indian Solar Energy Market Analysis'.

FY07-13.

The government of India in its 12<sup>th</sup> five-year plan has planned over 78,000 MW of generation capacity. There is a large demand-supply gap all over India. The average energy shortfall is at 9% and the peak demand shortfall of 13%. There are ample opportunities for players in the Indian power sector. The government has planned 9 Ultra Mega Power Plants (UMPP) projects of 4000 MW each. Natural Gas or CNG-based turbines can be installed at load centers or near gas terminals. The Ministry of Power has set a goal - Mission 2017: Power for All. A comprehensive Blueprint for Power Sector development has been prepared encompassing an integrated strategy for the development of the power sector by 2017.

## **2. LITERATURE REVIEW**

There are vast literature on Power sector stocks with Nifty index using Granger Causality Test. Some of the relevant literature is reviewed in the following.

Anoop Singh in 2010, "Private Investment in Power Sector in Developing Countries" stated that USD 9.8 trillion will be the estimated demand for investment in the electricity sector in the world by 2030. More than half of the investment would be required by the developing countries. To improve the investment climate for the private sector a number of developing countries have undertaken policy initiatives.

Ashwin Gambhir, Vishal Toro, Mahalakshmi Ganapathy from Prayas Group in 2012, "Decentralized Renewable Energy (DRE) Micro-grids in India" in remote rural electrification micro-grid systems plays an important role. They can have a high positive impact if implemented effectively. The cost of production from DRE projects is comparatively high. There are new regulatory policy instruments for more innovative sustainable business models and equitable tariffs. Policy and regulation can play a supportive role in promoting DRE by making finance more easily accessible. Similarly, there should be importance provided for community participation, as it is crucial for the long-term sustainability of the project.

Harjeet S. Kalsi in 2010, "Power sector reforms and opportunities", there is an urgent requirement for greater participation by the companies to distribute power, developing specifically superior quality products. The companies should also advocate the right equipment at the right place for the consumers. A proper flow of communication should be available to the customer. Cost cutting exercise should be followed for the better market share for the company.

S.N. Singh, M.P. Sharma and Ajit Singh in their research conducted in 2010 "Design of Mini Grid for SHP Plants" emphasized that the supply of power to remote rural areas in India can be done in a sustainable and cost efficient manner by optimizing the design of the mini grids. The design of the mini grid will be such that it will be running in isolated mode only for 8 hrs/day wasting the energy of 16 hrs/day. On the basis of the Break Even Point (BEP) the alternatives for optimization can be Alternate-V. It is a low line loss with shortest line length and minimum capital investment.

Soma Bhattacharya and Maureen L. Cropper in 2011, “Options for Energy Efficiency in India and Barriers to Their Adoption” have described that greater uses of more energy-efficient technologies in India would pay for themselves in the form of energy savings. India should design policies to improve the economic efficiency of energy use. It can also explore opportunities for financing to improve energy efficiency and international cooperation to help reduce global CO<sub>2</sub> emissions. A fundamental barrier is government policies that distort prices. Lack of information is another barrier. The Bureau of Energy Efficiency has not made labeling programs mandatory yet.

Vebhav Gupta in 2011, “Power Exchanges a Boon or Bane” has stated that changes in the world electricity markets have revolutionized the way markets have typically viewed electricity. There has been a transition from a vertically integrated private or public monopoly market structure. Electricity sector reforms have enabled competitive wholesale and retail mechanism. At geographical level due to the perishable nature of electricity a real time basis to optimize resource has been allocated for short-term bases. This short-term trading shall be organized on a equitable, transparent and efficient platform. A transparent market, vibrant on which buyers and sellers can meet the diverse needs of their consumer’s nationwide trade electricity contracts.

### **3. METHODOLOGY**

The study was carried out to compare and test the Granger Causality testing of the selected industrial securities with the Nifty index using their returns and to analyze the risk involved in each company in the sectors and risk involved in the sector for investment. Thus the study undertaken was Analytical Study.

#### **3.1. *Need for the study***

In India, the S&P CNX Nifty is the most scientific Index that was constructed keeping in mind Index funds and Index derivatives. All companies to be Included in the Index have a market capitalization of Rs.5 billion or more. The S&P CNX Nifty is a market capitalization – weighted Index i.e., price change in any of the Index securities will lead to a change in the index. This necessitates the need for analyzing the risk and return relationship of the selected stocks of power sector listed in the NSE and some of them are constituted in the Nifty index and their impact on the Nifty index

#### **3.2. *Sampling design***

The present study investigates Granger causality between power sector stocks and the stock market index (NIFTY) in the National Stock Exchange (NSE), India. The data for the study consisted of the daily closing prices of a sample of ten stocks listed on the NSE and the NIFTY over the period of seven years, from January 1, 2006 through to November 30, 2013. The sample stocks were selected by simple random sampling from the NSE-listed power sector stocks. The data was collected from the NSE website/archives.

#### **3.3. *Sampling plan***

**Sampling unit:** Ten power sector companies listed in NSE

**Sampling size:** 10

**Sampling procedure:** Simple Random sampling

### ***3.4. Hypothesis:***

The hypotheses for the study are

H<sub>0</sub>: There is significant relationship between the selected securities return and NIFTY return.

H<sub>1</sub>: There is no significant relationship between the selected securities return and NIFTY return.

### ***3.5. Limitations***

- Granger causality test assumes linear regression equation.
- Nifty is taken as Optimum Market portfolio.
- The lag taken for this research is 1.
- The significant level for p value is considered as 5%.
- In granger test x value is considered as Nifty and y values are considered as the companies.

### ***3.6. Granger causality test<sup>2</sup>***

Granger causality test is a technique for determining whether one time series is useful in forecasting another. Ordinarily, regressions reflect "mere" correlations, but Clive Granger argued that there is an interpretation of a set of tests as revealing something about causality.

A time series X is said to Granger-cause Y if it can be shown, usually through a series of F- tests on lagged values of X (and with lagged values of Y also known), that those X values provide statistically significant information about future values of Y. The test works by first doing a regression of  $\Delta Y$  on lagged values of  $\Delta Y$ . Once the appropriate lag interval for Y is proved significant (t-stat or p-value), subsequent regressions for lagged levels of  $\Delta X$  are performed and added to the regression provided that they 1) are significant in and of themselves and 2) add explanatory power to the model. This can be repeated for multiple  $\Delta X$ s (with each  $\Delta X$  being tested independently of other  $\Delta X$ s, but in conjunction with the proven lag level of  $\Delta Y$ ). More than one lag level of a variable can be included in the final regression model, provided it is statistically significant and provides explanatory power.

The researcher is often looking for a clear story, such as X granger-causes Y but not the other way around. In the real world, often, difficult results are found such as neither granger-causes the other, or that each granger-causes the other. Furthermore, Granger causality does not imply true causality. If both X and Y is driven by a common third process, but with a different lag, there would be Granger causality. Yet, manipulation of

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<sup>2</sup> [http://www.uh.edu/~bsorensen/gra\\_caus.pdf](http://www.uh.edu/~bsorensen/gra_caus.pdf)

one process would not change the other.

The Granger test can be applied only to pairs of variables and may produce misleading results when the true relationship involves three or more variables. (When, for example, both of the variables being tested are "caused" by a third, they may have no true relationship with each other, yet give positive results in a Granger test). A similar test involving more variables can be applied with vector auto regression.

Hacker and Hatemi-J (2006), have developed a new method for Granger causality, which is not sensitive to the normal distribution of the error term. This new method is especially useful in financial economics since many financial variables are non-normal.

### ***P-VALUE***

In statistical hypothesis testing, the p-value is the probability of obtaining a result at least as extreme as the one that was actually observed, assuming that the null hypothesis is true. The fact that p-values are based on this assumption is crucial to their correct interpretation. The lower the p-value, the less likely result, assuming the null hypothesis, so the more "significant" the result, in the sense of statistical significance – one often uses p-values of 0.05 or 0.01, corresponding to a 5% chance or 1% of an outcome that extreme, given the null hypothesis.

More technically, a p-value of an experiment is a random variable defined over the sample space of the experiment such that its distribution under the null hypothesis is uniform on the interval [0,1]. Many p-values can be defined for the same experiment. Generally, one rejects the null hypothesis if the p-value is smaller than or equal to the significance level, often represented by the Greek letter  $\alpha$  (alpha). If the level is 0.05, then results that are only 5% likely or less are deemed extraordinary, given that the null hypothesis is true.

## **4. ANALYSIS**

### ***4.1. KSK Energy Ventures Limited***

KSK Energy Ventures Plc. (KSK plc.) is a power project development company listed on Alternate Investment Market (AIM) of the London Stock Exchange. KSK operates in India through its downstream subsidiary, KSK Energy Ventures Limited (KSKEVL) that is currently listed on the National Stock Exchange and Bombay Stock Exchange in India. KSK's operations in the Indian Power Sector are powered by the growth opportunities it realizes and capitalizes on.

***Table 4.1.1: Granger Causality Test of KSK as a function of Nifty***

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1328			
Reduced model	1329	-1	1.175 05	0.278 56

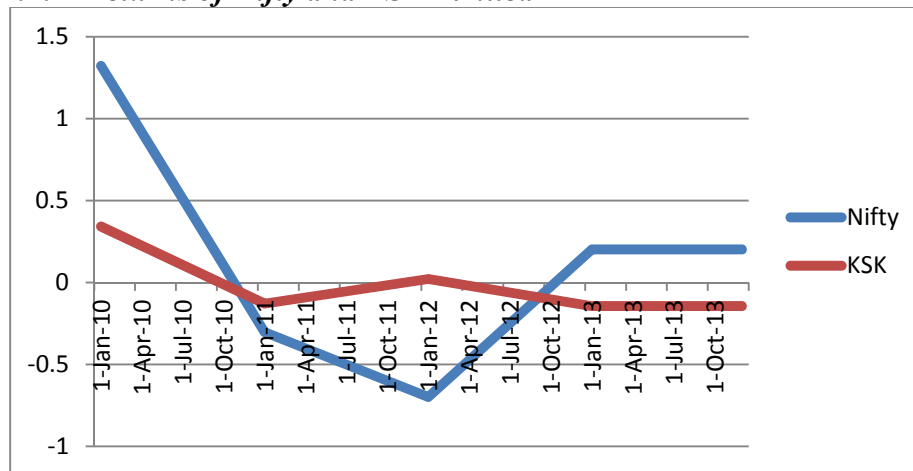
**Table 4.1.2: Granger Causality Test of Nifty as a function of KSK**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1328			
Reduced model	1329	-1	1.442 35	0.229 97

The result of Nifty granger and KSK granger is 0.28 and 0.23 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company KSK Energy Ventures Limited. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and KSK.

## Return

**Chart 4.1.1: Returns of Nifty and KSK Limited**



The returns of Nifty are better in 2010. In 2011 and 2012 the returns of KSK are better than the index and again the returns of nifty raises in 2013. But the interesting analysis is that the returns of KSK are more constant than that of nifty. The volatility in nifty is more and an investor looking for a less risk investment should invest in KSK rather than investing in nifty.

## 4.2 Jai Prakash Hydro-Power Limited<sup>3</sup>

Jaiprakash Hydro-Power Limited (JHPL), a part of the Jaypee Group owns and operates the 300 MW Baspa-II Hydroelectric Project at District Kinnaur, Himachal Pradesh.

**Table 4.2.1: Granger Causality Test of JP Power as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	0.635 64	0.425 38

<sup>3</sup> <http://www.jhpl.com/>

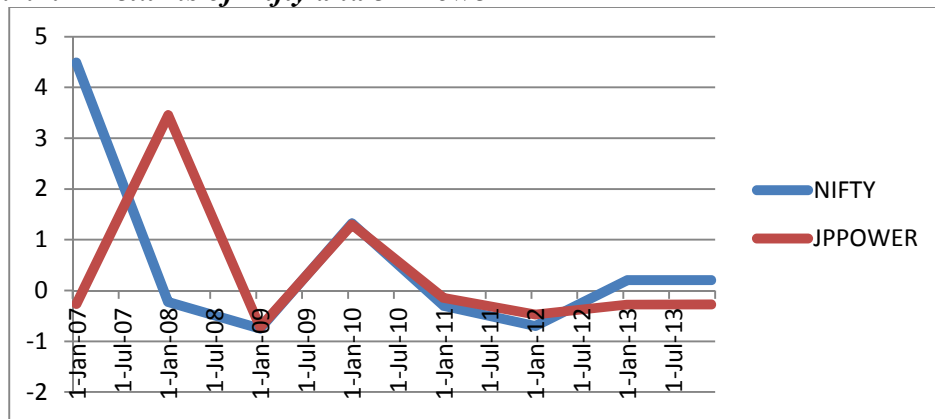
**Table 4.2.2: Granger Causality Test of Nifty as a function of JP Power**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	1.167 64	0.280 01

The result of Nifty granger and JP Power granger is 0.42 and 0.28 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company Jay Prakash Hydro-Power Limited. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and JP Power.

## Return

**Chart 4.2.1: Returns of Nifty and JP Power**



The return of JP Power is negative in 2007 whereas the returns of nifty are 4.5%. Then during the economic slowdown in India the index has drastically reduced and surprisingly the stock has shown a return of nearly 3.5%. In 2009-2010, the returns of the index and the stock are exactly the same. The index in 2013 is showing a positive return and the stock is showing a negative return.

## 4.3 NTPC<sup>4</sup>

India's largest power company, NTPC is emerging as a diversified power major with presence in the entire value chain of the power generation business. Apart from power generation, which is the mainstay of the company, NTPC has already ventured into consultancy, power trading, ash utilization and coal mining. Today, in the Forbes list of —the World's 2000 largest companies for the year 2007, NTPC occupies 411th place.

**Table 4.3.1: Granger Causality Test of NTPC as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D	Diff.	F	p-value

<sup>4</sup> <http://www.ntpc.co.in/>

	F	DF		
Complete model	1973			
Reduced model	1974	-1	1.345 64	0.246 18

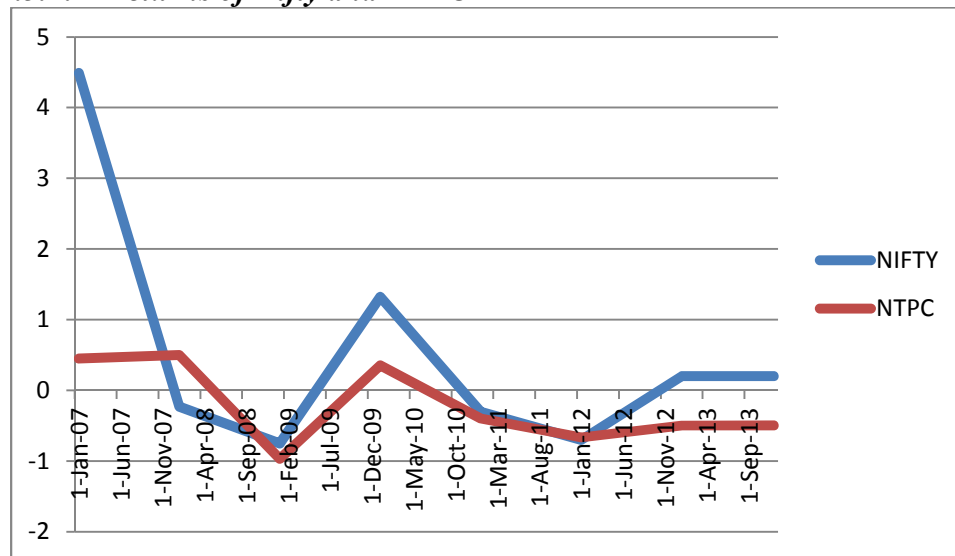
**Table 4.3.2: Granger Causality Test of Nifty as a function of NTPC**

Granger Causality Test: $X = f(Y)$				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	0.560 32	0.454 22

The result of Nifty granger and NTPC granger is 0.25 and 0.45 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company NTPC. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and NTPC.

## Return

**Chart 4.3.1: Returns of Nifty and NTPC**



The return on the stock and the index are positive in 2007. During the economic slowdown the returns of both the index and the stock have become negative and they have become positive in 2010. The stock has never seen a positive return after 2010 and is currently showing a positive return in 2013.

## 4.4 Suzlon Energy Limited<sup>5</sup>

Suzlon Energy Limited is a leader on the wind energy stage, a pioneer in end-to-end wind

<sup>5</sup> <http://www.suzlon.com/>



power solutions and ranks as the 5th leading supplier of wind turbines in the world.

**Table 4.4.1: Granger Causality Test of Suzlon as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	4.342 31	0.037 30

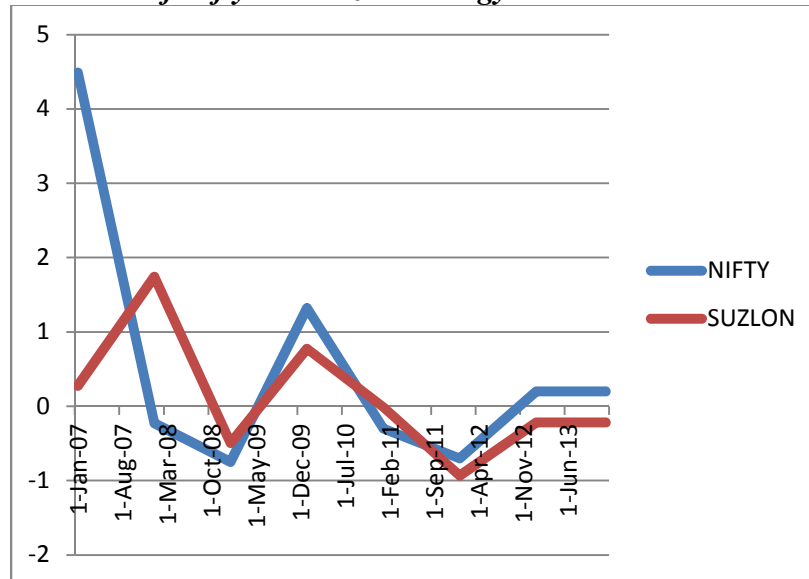
**Table 4.4.2: Granger Causality Test of Nifty as a function of Suzlon**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	0.031 38	0.859 39

The result of Nifty granger and Suzlon granger is 0.04 and 0.86 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company Suzlon Energy Limited. But, Suzlon granger is not the related to the nifty granger. Thus, the null hypothesis can be rejected, as the p value is not significant for Suzlon and nifty.

## Return

**Chart 4.4.1: Returns of Nifty and Suzlon Energy Limited**



The return of the index and the company are positive during 2007 and in 2008, the index has seen a huge decline but the stock had gradually decreased and became negative towards the end of 2008. From 2009, the index and the stock are almost positively correlated as they are providing returns in almost the same manner.

#### 4.5 TATA POWER LTD<sup>6</sup>

##### Driven by Growth – Fuelled by Power

Tata Power Limited recognized as India's largest private sector power utility, with a reputation for trustworthiness, built up over nearly nine decades, Tata Power surges ahead into yet another year with plans of sustained growth, greater value to consumer and reliable power supply.

**Table 4.5.1: Granger Causality Test of TATA Power as a function of Nifty**

Granger Causality Test: $Y = f(X)$				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	0.225 21	0.635 14

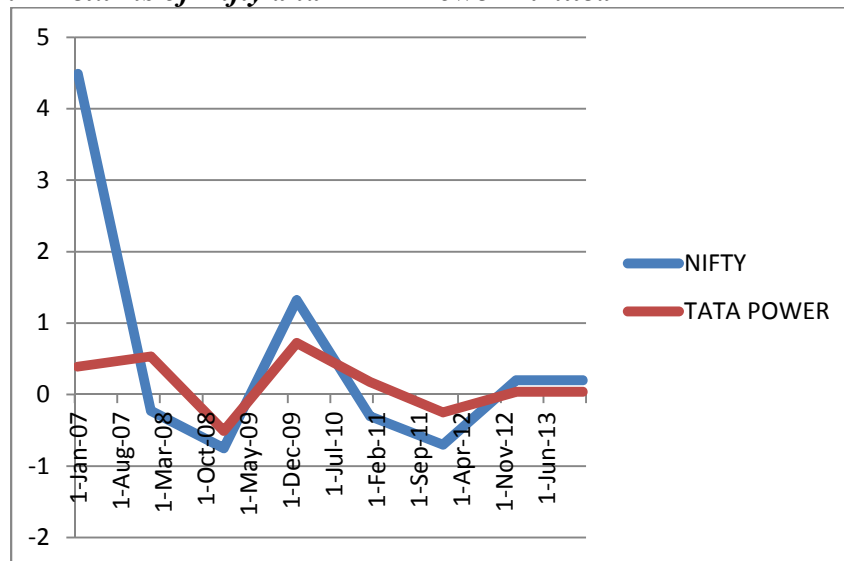
**Table 4.5.2: Granger Causality Test of Nifty as a function of TATA Power**

Granger Causality Test: $X = f(Y)$				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	2.572 19	0.108 91

The result of Nifty granger and TATA granger is 0.63 and 0.11 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company TATA Power Limited. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and TATA.

##### Return

**Chart 4.5.1: Returns of Nifty and TATA Power Limited**



<sup>6</sup> <http://www.tatapower.com/>

In 2007, the returns from the stock and the index are positive and have seen a negative return in 2008. From 2009-2010, the index and the stock have seen a positive return. The returns of the stock were better than the index from 2011 to the mid of 2012. In 2013, the returns of the index are positive and the returns of the stock are negligibly positive.

#### 4.6 POWER GRID CORPORATION OF INDIA POWERGRID

A Navratna Public Sector Enterprise is one of the largest transmission utilities in the world. Power Grid wheels about 45% of the total power generated in the country on its transmission network. Power Grid has a pan India presence with around 71,500 Circuit kms of Transmission network and 120 nos. of EHVAC & HVDC sub- stations with a total transformation capacity of 79,500 MVA.

**Table 4.6.1: Granger Causality Test of Power Grid as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1328			
Reduced model	1329	-1	0.178 39	0.672 82

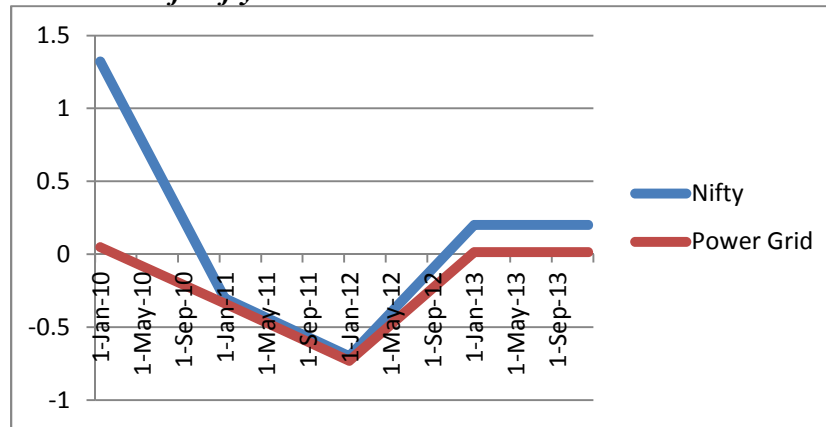
**Table 4.6.2: Granger Causality Test of Nifty as a function of Power grid**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1328			
Reduced model	1329	-1	0.084 32	0.771 57

The result of Nifty granger and Power Grid granger is 0.67 and 0.77 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company Power Grid. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and Power Grid.

#### Return

**Chart 4.6.1: Returns of Nifty and Power Grid**



The return of the nifty is positive and the return of Power Grid is minimally positive. The

return of the stock has seen a constant decrease from 2010-2012 and it has increased from 2012 and is currently showing marginal positive return and the index on the other hand is also showing a positive return.

#### 4.7 Calcutta Electric Supply Corporation (CESC)

The Calcutta Electric Supply Corporation or CESC is an Indian electricity generation and distribution company. The company serves the area in the city of Kolkata. The Kolkata municipal corporation has administered the following region of West Bengal to CESC for the distribution of power: Howrah, Hooghly, 24 Parganas (North) and 24 Parganas (South) districts.

**Table 4.7.1: Granger Causality Test of CESC as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	4.160 07	0.041 52

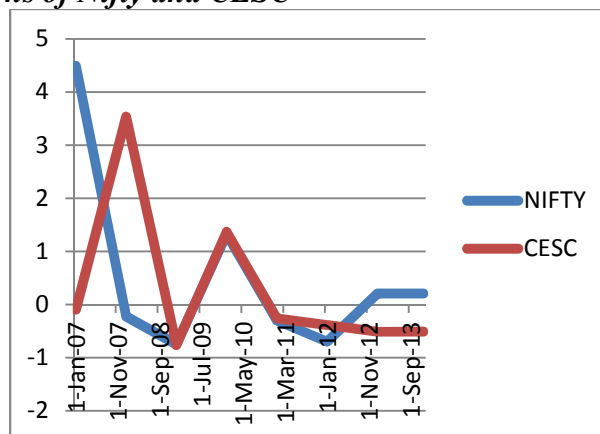
**Table 4.7.2: Granger Causality Test of CESC as a function of Nifty**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D	Diff.	F	p-value
	F	DF		
Complete model	1973			
Reduced model	1974	-1	1.759 54	0.184 83

The result of Nifty granger and CESC granger is 0.04 and 0.18 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company Calcutta Electric Supply Corporation. But, CESC granger is not the related to the nifty granger. Thus, the null hypothesis can be rejected, as the p value is not significant for CESC and nifty.

#### Return

**Chart 4.7.1: Returns of Nifty and CESC**



The return of CESC is negative in 2007 whereas the returns of nifty are 4.5%. Then during the economic slowdown in India the index has drastically reduced and surprisingly the stock has shown a return of nearly 3.5%. In 2009-2010, the returns of the index and the stock are exactly the same. The index in 2013 is showing a positive return and the stock is showing a negative return. CESC and JP Power have shown the same pattern of return against the index during the period analyzed.

#### 4.8 BF UTILITIES LTD

Bharat Forge had established the Financial Services division in the year 1990 to effectively deploy and leverage the financial resources of the company. The division performed extremely well and its assets grew rapidly. The Windmill Division was formed in late nineties to harness the wind energy for captive consumption of Bharat Forge and other group companies.

**Table 4.8.1: Granger Causality Test of BF Utilities as a function of Nifty**

Granger Causality Test: $Y = f(X)$				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	1.629 78	0.201 88

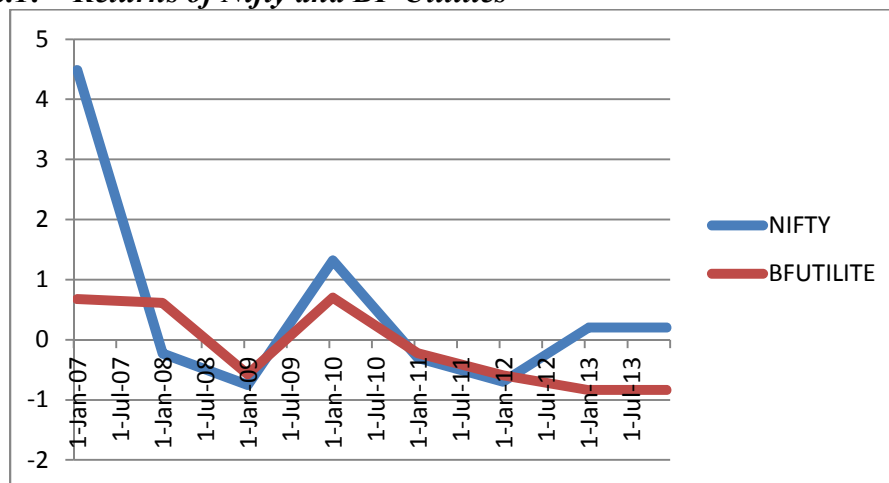
**Table 4.8.2: Granger Causality Test of Nifty as a function of BF Utilities**

Granger Causality Test: $X = f(Y)$				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	2.697 19	0.100 68

The result of Nifty granger and BF Utilities granger is 0.20 and 0.10 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company BF Utilities. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and BF Utilities.

#### Return

**Chart 4.8.1: Returns of Nifty and BF Utilities**



The return of the index and the stock is positive during 2007 and has become negative during 2008. They had again shown a positive return in 2010 and became negative in 2011. The stock has never shown a positive return from 2011 and the index is currently showing a positive return in 2013.

#### 4.9 DPSC Limited

DPSC Limited (DPSC) and Associated Power Co. Ltd., (APC) were incorporated in the year 1919 Primarily to supply power to the Bengal Coal Company Ltd., then the largest producer of Coal in Asia, and also to the Railways, Industries and Town ships in the Asansol - Raniganj areas.

**Table 4.9.1: Granger Causality Test of DPSC as a function of Nifty**

<b>Granger Causality Test: <math>Y = f(X)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	0.079 33	0.778 22

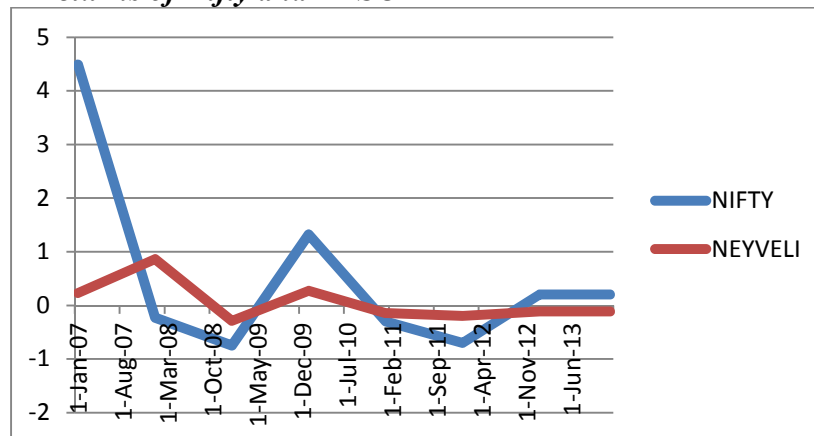
**Table 4.9.2: Granger Causality Test of Nifty as a function of DPSC**

<b>Granger Causality Test: <math>X = f(Y)</math></b>				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	1.342 37	0.246 75

The result of Nifty granger and DPSC granger is 0.78 and 0.24 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company DPSC. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and DPSC.

#### Return

**Chart 4.9.1: Returns of Nifty and DPSC**



#### Inference

The return of the stock and the index are showing a positive return in 2007 and a negative

return in 2008. But the stock mostly positive during 2008 when compared to the index. In 2010, the stock has shown a marginal profit and has never shown a positive return ever since. Whereas, the index is currently showing a positive return.

#### 4.10 BIL POWER

BIL Power is a “Power Engineering Solutions Company” based in Mumbai, India. It was incorporated in 1989. BIL Power Limited is engaged in power engineering solutions. The company is primarily engaged in the manufacture of transformers cores and lamination.

**Table 4.10.1: Granger Causality Test of BIL Power as a function of Nifty**

Granger Causality Test: $Y = f(X)$				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	6.072 48	0.999 37

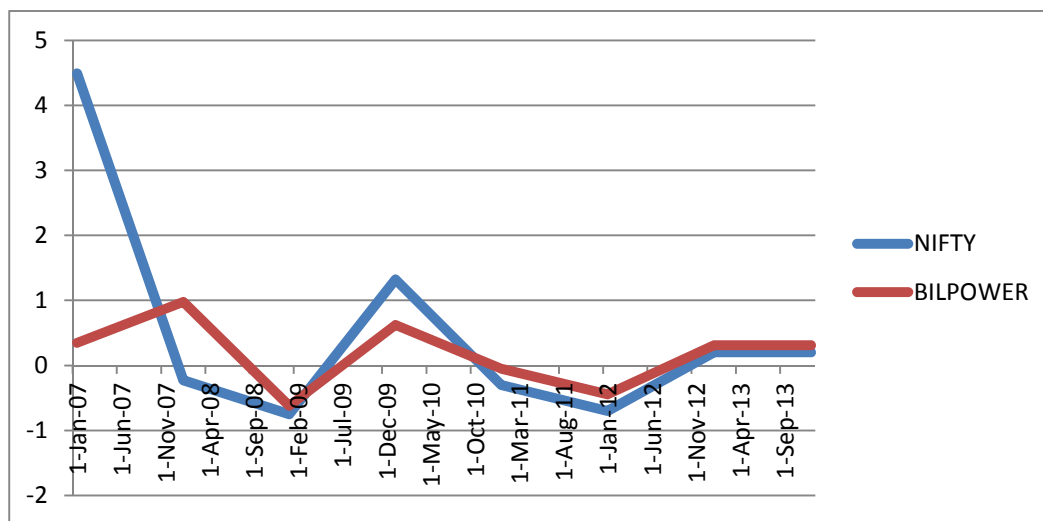
**Table 4.10.2: Granger Causality Test of Nifty as a function of BIL Power**

Granger Causality Test: $X = f(Y)$				
Model	Res.D F	Diff. DF	F	p-value
Complete model	1973			
Reduced model	1974	-1	2.522 43	0.112 39

The result of Nifty granger and BIL Power granger is 0.99 and 0.11 respectively, with the lag as 1 and 5% being the significant level. This signifies that nifty granger is related to the company BIL Power Limited. Thus, the null hypothesis cannot be rejected, as the p value is significant for nifty and BIL Power.

#### Return

**Chart 4.10.1: Returns of Nifty and BIL Power**



The return of the index and the stock are positive in 2007 and had become negative in 2008. From 2009 to current period the returns of the index and the stock are almost the same making them positively correlated. Both the index and the stock are showing positive returns currently.

## **5. Discussion**

The CAPM and the APT are the two most influential theories on asset pricing. There is abundant empirical evidence indicating that market risk alone does not explain the cross-sectional expected returns, suggesting that one or more additional factors may be required to characterize the behavior of expected returns. A number of studies have examined the impact of firm-specific variables such as firm size and book-to-market-value, while other studies have examined the impact of the macro-economic factors. The present study examines Granger causality in the context of the CAPM for the power sector in an Indian context. The study reports there was significant relationship with selected stock daily returns to the nifty index. The impacts of the stocks were significant in the nifty index. Results of the Granger causality regressions indicate that, for 20% of the sample stocks, there was no significant bi-directional causality between stock returns and market returns, so that the security line, represented by the regression is not meaningful for these stocks. For most of the stocks, there was bi-directional causality exists from the daily returns of both index and the selected stocks. For Suzlon and CESC, there was only uni-directional causality existence, i.e. the feedback from the nifty was not that much impact in these stocks. On the other hand, for 80% of the sample stocks, there was significant causality of stock returns with market returns in one of the direction, indicating in particular that market returns did explain stock returns for these stocks. The tests also indicate that, for some of the stocks, there is a significant drift component, and, for some of the stocks, there are significant drift and trend components. As a consequence of the rejection of any such causality processes in the daily returns of stocks and the daily returns of NIFTY, it can be concluded that the causality relations identified in the previous section are not spurious.

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