CHAPTER 6

IMPACT OF CRUDE OIL PRICES ON DEFENCE PAY AND ALLOWANCE

6.0 Introduction

India has one of the biggest defence force in the world with a strength of approximately 1.35 million men in arms. United States of America has about 1.5 million and China has about 2.2 million[41]. Indian's defence budget is about 2 lakh crores[42] out of which 55000 crores[43] go into pay and allowance of 1.35 million defence personnel. This chapter explores if change in international crude oil affects the pay and allowance of defence forces. This is analysed statistically by establishing a correlation between international crude oil price and pay and allowance of defence forces.

6.1 Dearness Allowance (DA)

Payment of DA stems from the need to protect the erosion in the real value of the salary on account of inflation. DA (Dearness Allowance) rates are fixed on the basic of All India Consumer Price Index for industrial workers. Base year has been taken as 2001[44]. This new DA rate system is adopted by Central and State Governments and public sector under takings from 01.01.2006 with new pay scale as declared by the Pay commission. DA rates are to be announced half yearly basis and applicable from first of January and first of

[41] http://www.globalfirepower.com/country-military-strength-detail.asp?country_id=India
[42] http://indiabudget.nic.in/
[43] Data taken from office of the Comptroller General of Defence Accounts
[44] http://labourbureau.nic.in/indnum.htm

July. The Union Cabinet on 24 Sep 2012 approved release of additional instalment of Dearness Allowance (DA) to Central Government employees and Dearness Relief (DR) to pensioners with effect from 01 Jul 2012, representing an increase of 7 per cent over the existing rate of 65 per cent of the Basic Pay/Pension, to compensate for Price rise[45]. The increase is in accordance with the recommendations of the 6th Central Pay Commission[46].

6.2 Calculation Dearness Allowance (DA)

To calculate Dearness Allowance with effect from Jan 2012, the average of monthly All India Consumer Price Index for industrial workers with the base year 2001=100 for the preceding 12 months is obtained and applied in the following formula

Dearness Allowance = (Average of AICPI for the past 12 months - 115.76)*100/115.76. ... (6.1)

Here 115.76 means average of price index from Jan 2005 to Dec 2005[47].

To calculate DA rate for July 2012 the Price index average from July 2011 to June 2012 is required. As per Labour Bureau, Department Statistics, Government of India average index for July 2011 to June 2012 is 199.58 (Table 6.1 refers). Hence the DA Calculation would be (199.58-115.76)* 100/115.6 which is seen as 72%. Thus DA declared is 72% with effect from 01 Jul 2012 (i.e. increase of 7 % from 01.01.2012)

[45] http://centralgovernmentemployeesnews.in/2012
[46] http://cgstaffnews.com/?page_id=4839
[47] http://labourbureau.nic.in/main2.html

Table 6.1: AICPI data for July 2011 to June 2012

Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
193	194	197	198	199	197	198
Feb-12	Mar-12	Apr-12	May-12	Jun-12	Total	Average
199	201	205	206	208	2396	199.58

Hence to calculate the DA which will be approved with effect from 01 Jan 2013 there is a need to calculate average AICPI index from 01 Jan 2012 to 31 Dec 2012. Taking the data for above period the average of AICPI data is 209.33. Same is referred at Table 6.2

Table 6.2: AICPI data for Jan 2012 to Dec 2012

Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12
198	199	201	205	206	208	212
Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total	AVG
214	215	217	218	219	2512	209.33

Thus the DA Calculation would be (209.33-115.76)* 100/115.6 which is equal to 80%. Thus DA will be declared as 80% with effect from 01 Jan 2013 (i.e. increase of 8 % from 01.07.2012)

Thus inflation has an impact on the defence pay and allowance budget through the DA component. It can be argued that "fuel and power" have a fixed percentage of weightage in the AICPI index and thus the impact of DA can be

calculated by factoring the fixed percentage. This is not all that simple. The fuel cost on the contrary has an impact on every sector in the economy. It can be argued that fuel costs impact agriculture directly. The input cost in agriculture includes fertilisers and the diesel required for water pumps. The fertilisers are naphtha based which in turn are crude determined. Moreover, the agriculture produces have to be transported which again is crude or fuel based. Thus fuel constitutes a significant component of agriculture cost. Similarly for steel, fuel contributes significantly in making of steel as energy (fuel) is required for ore mining, extraction, smelting, production and transportation as a finished good. Thus it can be said that fuel is a major contributor in determining the cost of a finished product and impacts all segments of AICPI. Hence it is evident that an increase in inflation increases the AICPI index which thus increases the DA. The same is tested statistically in the next section.

6.3 **Hypotheses**

Since one of the objectives is to study the impact of International crude prices on pay & allowance of defence budget, there is a need to first make hypotheses. Based on the data of crude oil prices and defence pay & allowance over the years, a statistical analysis will give us the relationship between crude oil price and defence pay and allowance. Hence the hypotheses constructed are:-

Ho = Increase in oil prices has no impact on Pay & Allowance component of Defence Budget

H_1 = Increase in oil prices has an impact on impact on Pay & Allowance component of Defence Budget

6.4 Relation between AICPI and Crude Oil Price

Table 6.3: AICPI, Crude Oil price and Inflation from 2002 -2012

Year	AICPI	Crude Oil Price in US $	Inflation
2002	104.3	24.95	4.469
2003	109.5	28.89	3.713
2004	114.7	37.76	3.891
2005	119.0	53.35	3.97
2006	123.0	64.27	6.268
2007	131.0	71.12	6.373
2008	141.6	97.03	8.349
2009	157.0	61.77	10.882
2010	179.7	79.03	11.989
2011	191.5	104	8.87
2012	209.3	106	9.13

Based on data given in Table 6.3, figure can be drawn between AICPI Index and crude price which is given at figure 6.1

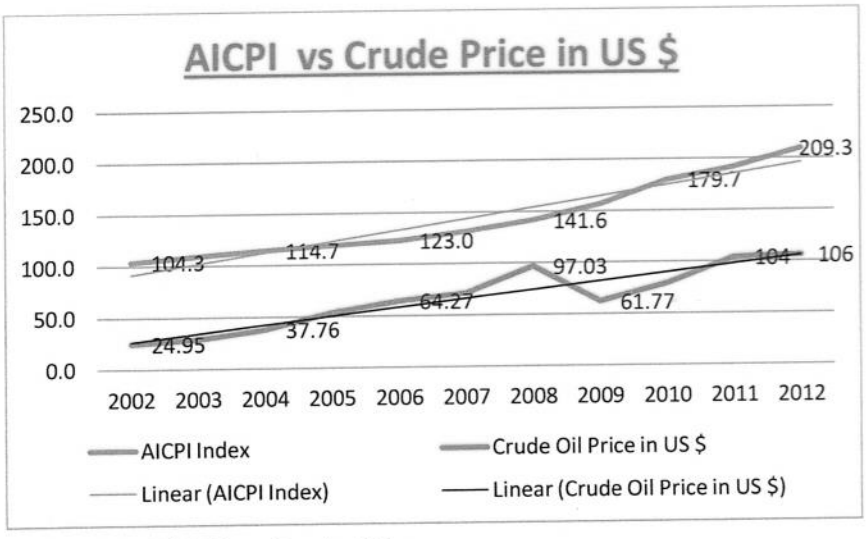

Figure 6.1: AICPI vs Crude Price

Figure 6.1 exhibits the trend in the increase in AICPI and Crude Oil price from 2002 to 2012. From the trend line it can be seen that barring for two years i.e. in 2009 and 2010, the rise in crude oil price ands rise in the AICPI are similar. Thus it is evident that a relationship exists between crude oil price and AICPI. To analyse the relationship statistically a hypotheses testing is conducted in next section.

6.5 **Scatter Plot**

The scatter plot between AICPI Index and Crude Oil price is given at Figure 6.2

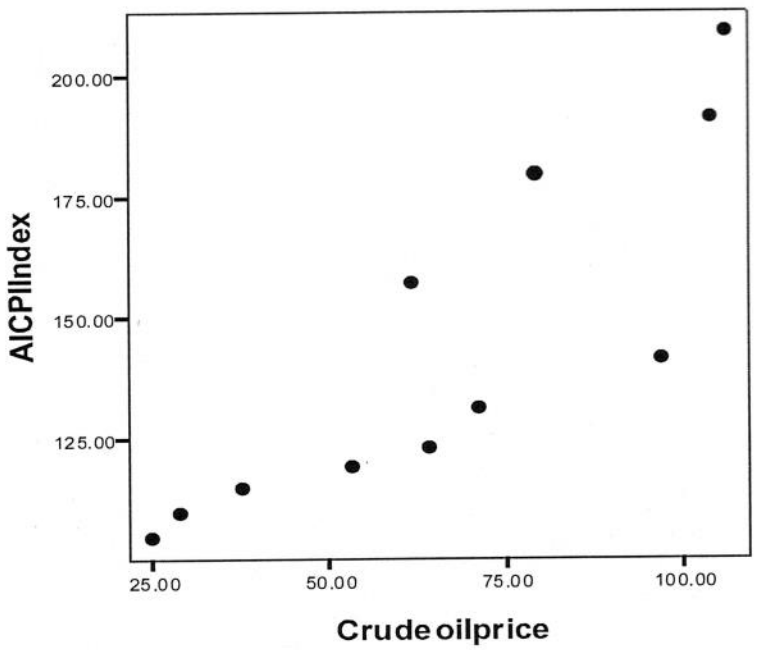

Figure 6.2 Scatter plot between Crude Oil Price and AICPI Index

The scatter plot reveals that there is no linear relationship between Crude Oil price and AICPI Index. Thus it is necessary to carry out curve estimation to understand relationship between crude oil price and AICPI Index.

6.6 **Statistical Output**

Table 6.4 summarizes all linear and curvilinear models with various parameter estimates. The model summary gives R Square which defines that amount of variation in dependent variable explained by the Independent variable. The significance value gives the P value of the ANOVA test conducted in Regression to check the overall validity of the model. A model to be significant, its P value should be less than α, the level of significance. The parameter estimates gives the value of constant and other estimates used in the model.

Table 6.4 Model Summary and Parameter Estimates

Dependent Variable: AICPIIndex

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.728	24.146	1	9	.001	73.207	1.065		
Logarithmic	.658	17.293	1	9	.002	-93.925	58.094		
Inverse	.550	10.998	1	9	.009	191.878	-2551.549		
Quadratic	.746	11.724	2	8	.004	97.821	.169	.007	
Cubic	.753	7.105	3	7	.016	44.216	3.342	-.047	.000
Compound	.763	29.054	1	9	.000	86.499	1.007		
Power	.713	22.359	1	9	.001	26.903	.403		
S	.617	14.471	1	9	.004	5.281	-18.005		
Growth	.763	29.054	1	9	.000	4.460	.007		
Exponential	.763	29.054	1	9	.000	86.499	.007		
Logistic	.763	29.054	1	9	.000	.012	.993		

The independent variable is Crudeoilprice.

Table 6.4 depicts the P value for the entire model. It can be seen that the P value in case of the entire model is < α (0.01) less case of cubic where the P value (.016) is > than α. Thus all models are statistically significant except cubic model. The R square value gives which model can explain the variation in AICPI index when crude oil price changes. It is evident that the compound, growth, exponential and logistic model have all the value 0.763 and thus are better than others in explaining the variation.

Based on above the equation for various curvilinear models will be

Compound Model

$\check{y} = 86.499 * (1.007)^X$ where Y is the predicted AICPI Index and X is the crude Oil Price .....(6.2)

Logistics Model

$\check{y} = 1/(0.011*(0.99)^X)$ where Y is the predicted AICPI Index and X is the crude Oil price .....(6.3)

Growth Model

$\check{y} = \exp(4.46+0.00726 * X)$ where Y is the predicted AICPI Index and X is the crude Oil price .....(6.4)

Exponential Model

$\check{y} = 86.499*\exp(0.007*X)$ where Y is the predicted AICPI Index and X is the crude Oil price ....(6.5)

The best model can be identified by putting existing value of X and calculating $\check{y}$ value. The equation which has the nearest $\check{y}$ value with the existing value is the best model

Table 6.5 : Comparison of Models

Crude Oil Price	Compound	Growth	Exponential	Logistic	Actual AICPI
24.950	102.943	103.662	103.006	107.083	104.300
37.760	112.565	113.765	112.669	121.796	114.700

From Table 6.5 it can be seen that the growth model calculation is the nearest to the existing AICPI and thus is the best fit model

Thus the predictive equation is

$\check{y}$ = exp(4.46+0.00726 * X) where $\check{y}$ is the predicted AICPI Index and X is the crude Oil price

The Model is

$$\hat{\text{AICPI}} \text{ Index} = \exp(4.46+0.00726 * \text{crude oil price}) \quad \ldots.(6.6)$$

Having established a relationship between AICPI and crude oil, there is a need to establish a relationship between AICIP and Pay & Allowance. Details of Pay & Allowances have been obtained from Comptroller General of Defence Accounts and are placed at Appendix II

Table 6.6 : AICPI Index and Defence Pay Allowance

Year	AICPI Index	Pay and Allowance in Crores
2002	104.3	15253.57
2003	109.5	16127.87
2004	114.7	16484.03
2005	119.0	17811.65
2006	123.0	18814.56
2007	131.0	19822.99
2008	141.6	21365.67
2009	157.0	34406.58
2010	179.7	50978.06
2011	191.5	49098.3
2012	209.3	55719.48

Based on data given in Table 6.6, figure can be drawn between AICPI Index and Defence Pay & Allowance which is given at Figure 6.3

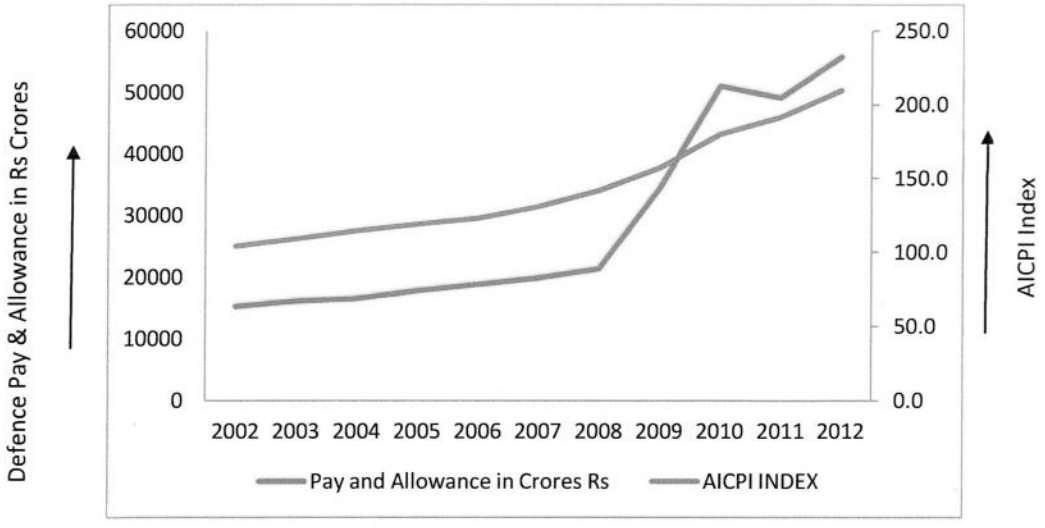

Figure 6.3 : AICPI Index and Defence Pay * Allowance

6.6 **Relationship between AICPI and Pay and Allowance**

Figure 6.3 depicts the trend in the increase in AICPI Index and Defence Pay & Allowance from 2002 to 2012. It is evident that the rise in AICPI Index and rise in Defence pay and allowance are similar barring 2008 to 2010 which can be attributed to backlog payment of sixth pay commission. Thus it is evident that a relationship exists between AICPI Index and Defence Pay and allowance. To analyse the relationship statistically a hypotheses testing is conducted in next section.

6.8 Scatter Plot between AICPI and Pay & Allowance

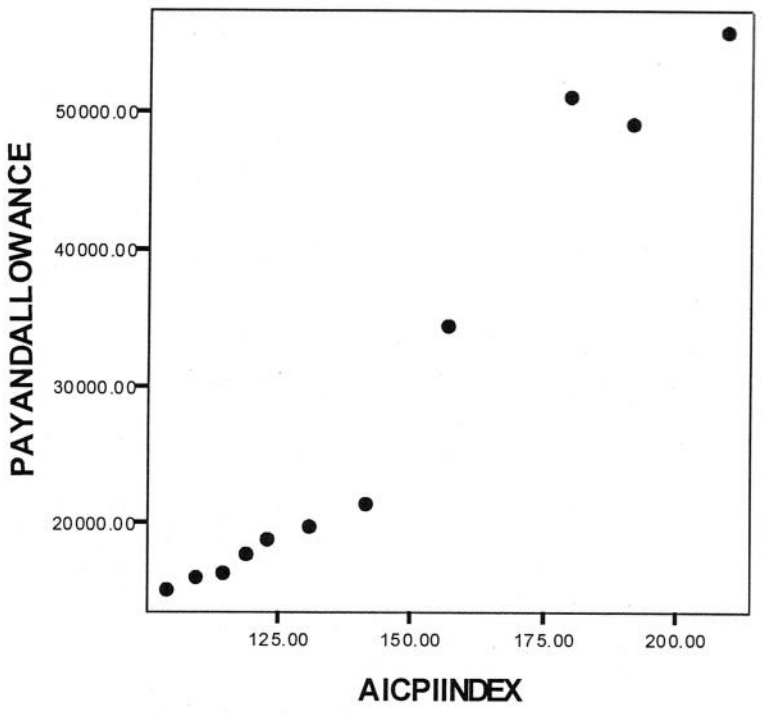

Figure 6.4 : Scatter plot between AICPI Index and Defence Pay & Allowance

The scatter plot reveals that there is no linear relationship between AICPI Index and Defence Pay & allowance. Thus it is necessary to carry out curve estimation to understand relationship between AICPI Index and Defence Pay & allowance.

6.9 Statistical Output

Table 6.7 gives the model summary and parameter estimation. From the Table 6.7 it can be deduced that which model is more appropriate for the data set based on the value of R square

Table 6.7: Model Summary and Parameter Estimates of Various Curvilinear Models

Dependent Variable: PAYANDALLOWANCE

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.953	181.774	1	9	.000	-33350.023	431.945		
Logarithmic	.931	121.998	1	9	.000	-287892.802	64077.747		
Inverse	.893	74.781	1	9	.000	95212.154	-9074877.586		
Quadratic	.957	88.557	2	8	.000	-9518.501	106.870	1.049	
Cubic	.958	91.417	2	8	.000	-6909.888	.000	2.116	-.003
Compound	.962	230.637	1	9	.000	3419.249	1.014		
Power	.960	214.579	1	9	.000	.836	2.089		
S	.939	138.205	1	9	.000	12.330	-298.828		
Growth	.962	230.637	1	9	.000	8.137	.014		
Exponential	.962	230.637	1	9	.000	3419.249	.014		
Logistic	.962	230.637	1	9	.000	.000	.986		

The independent variable is AICPIINDEX.

Table 6.7 summarizes all linear and curvilinear models with various parameter estimates. The model summary gives R Square which defines that amount of variation in dependent variable explained by the Independent variable. The significance value gives the P value of the ANOVA test conducted in Regression to check the overall validity of the model. A model to be significant, its P value should be less than α, the level of significance. The parameter estimates gives the value of constant and other estimates used in the model

Table 6.7 depicts the P value for the entire model. It can be seen that the P value in case of the entire model is < α (0.01). Thus all models are statistically significant. The R square value gives which model can explain the variation in Defence Pay& allowances when AICPI changes. It is evident that the

compound, growth, exponential and logistic model have all the value 0.962 and thus are better than others in explaining the variation.

Based on above the equation for all models will be

Compound

$\check{y} = 3419.249 * (1.014)^X$ where $\check{y}$ is the predicted Defence Pay & Allowance and X is the AICPI Index .....(6.7)

Logistics

$\check{y} = 1/(0.000292*(0.986)^X)$ where $\check{y}$ is the predicted Defence Pay & Allowance and X is the AICPI Index .....(6.8)

Growth

$\check{y} = \exp(8.137+0.0139 * X)$ where $\check{y}$ is the predicted Defence Pay & Allowance and X is the AICPI Index .....(6.9)

Exponential

$\check{y} = 3419.249*\exp(0.01393*X)$ where $\check{y}$ is the predicted Defence Pay & Allowance and X is the AICPI Index ....(6.10)

The best model can be identified by putting existing value of X and calculating $\check{y}$ value. The equation which has the nearest $\check{y}$ value with the existing value is the best model

Table 6.7 : Comparison of Models

AICPI Index	Compound	Growth	Exponential	Logistic	Def Pay & Allowance
191.5	Rs. 49,000.34	Rs. 48,964.46	Rs. 49,255.25	Rs. 50,955.13	Rs 49098.3

From Table 6.7 it can be seen that the compound model is the nearest to the existing Defence Pay & Allowance and thus is the best fit model

Thus the equation is

$\check{y} = 3419.249*(1.014)^{X}$ where $\check{y}$ is the predicted Defence Pay & Allowance and X is the AICPI Index

The Model thus is

$$\text{Defence Pay \& allowance} = 3419.249*(1.014)^{\text{AICPI Index}} \quad .....(6.11)$$

Assuming the price of Crude Oil rises to $ 130 then the AICPI Index can be predicted from Equation 6.6

AICPI Index = exp(4.46+0.00726 * crude oil price) =222.24

Using this value of AICPI Index in Equation 6.11

$$\text{Defence Pay \& allowance} = 3419.249*(1.014)^{\text{AICPI Index}}$$

The pay and allowance can be predicted 75138.47 Crores

6.10 **Implication**

Defence expenditure need to be constantly monitored to ensure additional budget can be demanded from Ministry of Finance as and when the expenditure increases. This model gives a mechanism of finding out increase in pay & allowance budget in case of Increase in crude oil price.

6.11 **Conclusion**

The Crude oil price has a correlation with AICPI Index which has a correlation with Defence Pay & Allowance. Thus rise in crude oil price will lead to rise in AICPI Index and subsequently Defence Pay & Allowance. Thus a model is available with the budget planners to plan the budget in case the crude oil price fluctuates widely.