CHAPTER 3-
METHODOLOGY
In the last chapter the contributions of the different researchers and the gaps in literature were explained. This chapter primarily aims at explaining the methodology used in the study. This chapter is divided into three sections. The first section explains the objectives and the hypotheses. Second section elucidates the sources of the data and the third section describes the model.

3.1 OBJECTIVES AND HYPOTHESES

3.1-1 OBJECTIVES

The main objectives of the present study are given below:

1. To study the relative shares of strikes and lockouts in pre and post-reform periods in all sectors.

2. To discern the relative shares of strikes and lockouts in total disputes in each sector (public and private sectors) in pre and post-reform periods in manufacturing industries.

3. To analyze the comparative shares of public and private sectors in disputes / strikes / lockouts in pre and post-reform periods in manufacturing industries.

4. To find the causes of disputes, strikes and lockouts in manufacturing industries.

3.1-2 HYPOTHESES

Based on the review of literature following hypotheses are framed:

1. In contrast to the pre-reform period, the relative share of strikes has gone down and the share of lockouts has gone up in post-reform period all sectors in manufacturing industries.
2. In the public sector, as compared to the pre-reform period, the share of strikes is expected to fall and the share of lockouts is expected to increase relatively in post-reform period. The same is expected in private sector.

3. As compared to the pre-reform period, the comparative share of public sector is expected to decrease and the share of private sector is expected to increase in disputes, strikes and lockouts in post-reform period.

4. It is expected that disputes and strikes are positively related with the degree of trade unionization whereas lockouts are negatively related with the same variable. Further, disputes and strikes have negative relationship and lockouts have positive relationship with real wages and salaries per worker. It is also expected that disputes, strikes and lockouts decrease with the increase in the average factory size. The dummy variable D1 is expected to have a positive impact and D2 is expected to have a negative relationship with the dependent variable.

3. II SOURCES OF DATA AND COVERAGE OF INDUSTRIES

3. II-1 SOURCES OF DATA

The data used in the study are of secondary nature. In India, the data on industrial disputes are collected by Ministry of Labour and Employment, Government of India, through Labour Bureau, Shimla and Chandigarh. Labour bureau releases various reports on which the data for manufacturing industries are available on disputes (both strikes and lockouts), strikes and lockouts. Any dispute which involves less than 10 workers is not covered. Also, political strikes or any sympathetic demonstrations are not covered. The data on disputes for manufacturing industries are available from 1981 to 2007 but the separate industry wise data on strikes and lockouts are available from 1984 to 2007. For disputes, strikes and lockouts the data are available on three variables: number, mandays lost and workers involved. Number of disputes /strikes/lockouts is a measure of incidence of disputes and it is also called as the frequency measure. Worker
involved in disputes / strikes / lockouts is a direct measure as more involvement of the workers indicates its straight impact on the workers.

Further, mandays lost is a measure of the costs of the disputes as more loss of mandays means more loss of wages incurring to the workers and more loss of production and profits to the employers (Sundar, 1994). In the present study for testing the first three hypotheses, all the three measures (number, mandays lost and workers involved) are covered. Further, the data on disputes are divided into sectors also: public and private sectors. In each sector the data are available on all disputes, strikes and lockouts for all the three measures (number, mandays lost and workers involved). Thus, in order to have a better assessment the analysis has been done in all sectors, public and private sectors. This is further elaborated in figure 3.II-1. For other variables (number of factories, number of workers, wages and salaries and wholesale price index) the data are extracted from the various publications of CSO and RBI. For trade union membership the data are accessed from the various issues of ‘Trade Unions in India’ published by Labour Bureau which is explained in detail in the next sections.

3.II-2 COVERAGE OF INDUSTRIES

The study covers manufacturing industries. For the present study NIC 2004 classification has been used. The data on disputes for 1981 to 1990, 1991 to 1999 and 2000 to 2007 are collected as per NIC 1970, NIC 1987, and NIC 1998 respectively. Therefore, in order to bring the data on NIC 2004 necessary conversions have been made. Due to these conversions some industries could not be covered under the analysis as in order to move from one classification to another, data on 4 digit are required. However, Labour bureau does not provide the data on disputes on 4 digit. Due to the same reasons some industries had to be clubbed. These were:

- 311 (manufacture of electric motors, generators and transformers) and 312 (manufacture of electricity distribution and control apparatus) have been clubbed under 311.
• 341 (manufacture of motor vehicles), 342 (manufacture of bodies for motor vehicles; manufacture of trailers and semi-trailers) and 343 (manufacture of parts and accessories for motor vehicles and their engines) have been clubbed under 341.

Thus, in all 46 manufacturing industries are covered¹.

Figure 3.II-1 Variables in the Different Sectors

¹ The list of industries along with their codes is given in Appendix A.
3.III DATA ANALYSIS

In this study to test the first three hypotheses various ratios have been calculated. These are given below (figure 3.III-1):

- In order to find out the relative shares of strikes and lockouts in all sectors, percent share of strikes/lockouts in an industry to total disputes (number of disputes/mandays lost/workers involved) has been calculated.

- Further, percent share of disputes in public and private sectors in an industry to total disputes in that industry (number of disputes/mandays lost/workers involved) have been calculated. Likewise, the industry wise relative shares of public and private sectors in total strikes (number of disputes/mandays lost/workers involved) and total lockouts (number of disputes/mandays lost/workers involved) have been estimated.

- For finding out the relative shares of strikes and lockouts in public sector, percent share of strikes and lockouts in an industry to total disputes in public sector in that industry (number of disputes/mandays lost/workers involved) has been calculated. The same ratio has been calculated for the private sector.

- Also, to get a better picture of the impact of disputes, social and individual intensities of disputes, strikes and lockouts in all sectors have been calculated. Social intensity implies mandays lost per dispute/strike/lockout and individual intensity implies mandays lost per worker involved in dispute/strike/lockout. The same ratios have been calculated for disputes/strikes/lockouts in public and private sectors. Also, workers involved per dispute/strike/lockout in all sectors, public and private sectors have been calculated.

These ratios are calculated for pre and post-reform periods. The pre-reform period of all disputes is from 1981 to 1991 and the pre-reform period of strikes and lockouts is from 1984-1991. The post-reform period of disputes, strikes and lockouts is from 1991 to 2007.
In order to estimate determinants, the model given by Saha and Pan (1994) is followed. In this model the analysis is done at 2 digit level and it covers 19 manufacturing industries for 1980-1986. The study covers disputes which include both strikes and lockouts. The dependent variable is mandays lost in disputes per employee in an industry. The independent variables are degree of trade unionization, average monthly earnings of an employee and average factory size. A dummy variable has been incorporated in the model in order to capture the impact of long disputes like the textile strike. GLS is used to estimate the coefficients. The results of the study reveals that degree of trade unionization and average factory size are the important determinants of disputes but employee’s earnings are found to be weak in affecting disputes. However, Saha and Pan have applied the model on disputes which includes both strikes and lockouts. But in the present research the same model would be applied to disputes, strikes and lockouts separately.

Thus, the present research is different as the determinants of disputes, strikes and lockouts would be investigated separately. The present study also makes an attempt to study the changes in the relationship between the dependent and the independent variables in pre and post reform periods.

The different variables, time period, and the different regression model are explained below:

- **Dependent variables**

  The dependent variables in the different regression equations are:

  1. In order to identify the determinants of disputes, the dependent variable is mandays lost in disputes per worker in an industry.

  2. For ascertaining the determinants of strikes the dependent variable is mandays lost in strikes per worker in an industry.

  3. Lastly, to find out the determinants of lockouts, the dependent variable is mandays lost in lockouts per worker in an industry.
Figure 3.III-1 Steps in the Estimation of Incidence and Impact of Disputes, Strikes and Lockouts in Different Sectors

- Relative share of public and private sectors in disputes/strikes/lockouts
- Relative share of strikes and lockouts in all sectors
- Industry wise percent share of strikes/lockouts in an industry to total all disputes (number/mandays lost/workers involved)
- Industry wise percent share of strikes in public and private sectors in an industry to total strikes in that industry (number/mandays lost/workers involved)
- Industry wise percent share of lockouts in public and private sectors in an industry to total lockouts in that industry (number/mandays lost/workers involved)
- Industry wise percent share of strikes and lockouts in an industry to total all disputes in public sector (number/mandays lost/workers involved)
- Industry wise percent share of strikes and lockouts in an industry to total all disputes in private sector (number/mandays lost/workers involved)
- Industry wise percent share of strikes/lockouts in private sector
- Social and individual intensities of strikes/lockouts in public sector
- Social and individual intensities of disputes/strikes/lockouts in all sectors
- Workers involved per dispute/strike/lockout
- Workers involved per dispute/strike/lockout in public and private sectors
- Relative share of public and private sectors in disputes/strikes/lockouts
- Relative share of strikes and lockouts in all sectors
- Industry wise percent share of strikes/lockouts in an industry to total all disputes (number/mandays lost/workers involved)
- Industry wise percent share of strikes in public and private sectors in an industry to total strikes in that industry (number/mandays lost/workers involved)
- Industry wise percent share of lockouts in public and private sectors in an industry to total lockouts in that industry (number/mandays lost/workers involved)
- Industry wise percent share of strikes and lockouts in an industry to total all disputes in public sector (number/mandays lost/workers involved)
- Industry wise percent share of strikes and lockouts in an industry to total all disputes in private sector (number/mandays lost/workers involved)
- Industry wise percent share of strikes/lockouts in private sector
- Social and individual intensities of strikes/lockouts in public sector
- Social and individual intensities of disputes/strikes/lockouts in all sectors
- Workers involved per dispute/strike/lockout
- Workers involved per dispute/strike/lockout in public and private sectors

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The data on the number of workers in an industry are accessed from Government of India, Ministry of Statistics and Programme Implementation, Annual Survey of Industries, Central Statistics Office, New Delhi.

- Independent variables

The independent variables included in the models are:

1. **Degree of trade unionization (TU):**

   Trade unions are believed to play a dominant role in the occurrence of disputes, strikes and lockouts. Trade unions not only lead the workers in the negotiations but are also, responsible for clinching shares from the employers. These are also known to have strong political affiliations which may affect the course of dispute and bargaining. Thus, the inclusion of this variable is a must for any research on the causes of disputes. However, the data on trade union membership are available on two heads: employers union and workers union. The membership of the employers union could not be included in the analysis as the data are not available for 3 digit industries. Thus, trade union membership includes only the membership of workers union. Hence, degree of trade unionization is defined as membership of trade unions in an industry divided by number of workers in that industry. The data on trade union membership are accessed from the various issues of ‘Trade Unions in India’, published by Government of India, Ministry of Labour and Employment, Labour Bureau, Chandigarh.

2. **Real wages and salaries per worker (WS):**

   Wages and salaries are one of the important reasons for which workers go on a strike. The industry wise data on wages and salaries have been extracted from Government of India, Ministry of Statistics and Programme Implementation, Annual Survey of Industries, Central Statistics Office, New Delhi. Wages and salaries are deflated using the wholesale price index (WPI) given by RBI. These real wages and salaries in an industry are then divided by the number of workers in that industry.
3. **Average factory size (FS):**

The size of factory also determines disputes as in large factories the number of workers is also large and hence, both the employers and the workers invest in protecting their interests. Large factories are usually under the watch of the Government and are supposed to implement the various provisions of the Acts. Such factories also invest in hiring specialized staff to deal with the problems of disputes. Therefore, it would be interesting to know if disputes, strikes and lockouts decrease with the increase in the size of the factory. This variable has been obtained by dividing number of workers in an industry by the number of factories in that industry. The data on number of factories are accessed from Government of India, Ministry of Statistics and Programme Implementation, Annual Survey of Industries, Central Statistics Office, New Delhi.

4. **Dummy variables**

Apart from the above mentioned variables two dummy variables are also included. D1 is included in the overall period of disputes and pre-reform period of disputes for 1981 to 1984 so as to cover the impact of the historic textile strikes and the similar disputes on other industries. Therefore, D1 is introduced in the following industries: tobacco (160), spinning, weaving and finishing of textiles (171), other textiles (172), knitted and crocheted fabrics and articles (173), electric motors, generators, transformers and manufacture of electricity distribution and control apparatus (311), insulated wire and cable manufacture (313), manufacture of accumulators, primary cells, and primary batteries (314), electric lamps and lighting equipment (315), other electric equipment (319). Further, as the year 1991 marks a watershed in the economic history of India, therefore, to capture the impact of economic reforms on disputes in the different industries, D2 dummy variable is also introduced in the overall periods of disputes, strikes and lockouts.

The data on the causes of disputes show that indiscipline and violence is one of the main determinants of disputes but industry wise (3 digit) data on this variable are not available. Hence, this variable is excluded from the models. Further, the data on trade
union membership are not available for public and private sectors at 3 digit level. Therefore, the analysis has been done for all sectors only.

- **Time period**

  The data on strikes and lockouts are available from 1984-2007 whereas the data on disputes are available from 1981-2007. However, the data for trade union membership are available only from 1981-2006. Therefore, the analysis has been done till 2006. Thus, the time period of the disputes is from 1981 to 2006. The time period of strikes and lockouts is from 1984 to 2006.

- **Regression model**

  The basic regression equation can be written as:

  \[
  \text{MDL/NW} = f(\text{TU}, \text{WS}, \text{FS}, e)
  \]

  Where,

  - MDL/NW = mandays lost per worker in an industry.
  - TU = degree of trade unionization in an industry.
  - WS = real wages and salaries per worker in an industry.
  - FS = average factory size in an industry.
  - e = error term.

  The different equations are:

  1. **All disputes (overall period - from 1981 to 2006)**

     For all disputes the regression equation is:

     \[
     \text{MDL}_{\text{AD}}/\text{NW} = f(\text{TU}, \text{WS}, \text{FS}, D_1, D_2, e_1)
     \]

     Where,
MDL_{AD}/NW = mandays lost in disputes per worker in an industry,

TU = degree of trade unionization in an industry,

WS = real wages and salaries per worker in an industry,

FS = average factory size in an industry,

e_1 = error term.

For 1981, D1 = 1 for 160, 171, 172, 173, 311, 313, 314, 315, 319, 173, D1 = 0 otherwise.

For 1982, 1983 and 1984, D1 = 1 for 171, 172, 173, 173, D1 = 0 otherwise.

Likewise, D2 = 1 for 1992-2006 for all industries

D2 = 0 for 1981-1991 for all industries.

2. Strikes (overall period- from 1984 to 2006)

The regression equation for strikes is:

MDL_{SK}/NW = f (TU, WS, FS, D2, e_2)

Where,

MDL_{SK}/NW = mandays lost in strikes per worker,

e_2 = error term.

D2 = 1 for 1992-2006 for all industries,

D2 = 0 for 1984-1991 for all industries.
3. **Lockouts (overall period- from 1984 to 2006)**

The regression equation for lockouts is:

\[
\text{MDL}_{lk}/NW = f (TU, WS, FS, D2, e_3)
\]

Where,

\[
\text{MDL}_{lk}/NW = \text{mandays lost in lockouts per worker},
\]

\[
e_3 = \text{error term.}
\]

\[
D2 = 1 \text{ for 1992-2006 for all industries,}
\]

\[
D2 = 0 \text{ for 1984-1991 for all industries.}
\]

In order to know the changes in the relationship between the dependent variable and the independent variables before and after the reforms the analysis has also been done for pre and post-reform periods for disputes, strikes and lockouts. Thus, in each industry 3 regression equations for overall periods and 3 regression equations for pre and post-reform periods of disputes, strikes and lockouts are framed. The pre and the post-reform equations are given below:

4. **All disputes (pre-reform period- from 1981 to 1991)**

\[
\text{MDL}_{AD}/NW = f (TU, WS, FS, D1, e_4)
\]

Where,

\[
e_4 = \text{error term.}
\]

For 1981, \(D1 = 1\) for 160, 171, 172, 173, 311, 313, 314, 315, 319,

\(D1 = 0\) otherwise.

For 1982, 1983 and 1984, \(D1 = 1\) for 171, 172, 173,

\(D1 = 0\) otherwise.
5. All disputes (post-reform period - from 1992 to 2006)

\[ \text{MDL}_{\text{AD}}/\text{NW} = f(\text{TU}, \text{WS}, \text{FS}, e_5) \]

Where,

\[ e_5 = \text{error term.} \]

In the post-reform period D2 has not been included as D2 = 1 for 1992-2006 and D2 = 0 for 1981-1991. However, in post-reform period there is data only for 1992-2006 and not for 1981-1991. Therefore, in post-reform period D2 would be always equal to 1 for all industries and hence, it would be always constant. Therefore, D2 is not included in post-reform period. However, in pre-reform model D1 is included because D1 is equal to 1 for selected industries (as mentioned above) for 1981-1984 and hence, it is zero for the remaining years (1985-1991).


\[ \text{MDL}_{\text{sk}/\text{NW}} = f(\text{TU}, \text{WS}, \text{FS}, e_6) \]

Where,

\[ e_6 = \text{error term.} \]

D1 is not included in pre-reform period of strikes and lockouts as the data for pre-reform period of strikes is from 1984-1991 and D1 is included for 1981-1984.


\[ \text{MDL}_{\text{sk}/\text{NW}} = f(\text{TU}, \text{WS}, \text{FS}, e_7) \]

Where,

\[ e_7 = \text{error term.} \]

8. Lockouts (pre-reform period- from 1984 to 1991)

\[ \text{MDL}_{\text{lk}/\text{NW}} = f(\text{TU}, \text{WS}, \text{FS}, e_8) \]
Where,

e_8 = error term.


\[ MDL_{lk/NW} = f (TU, WS, FS, e_9) \]

Where,

\( e_9 = \) error term.

Since in the present research the same industry is studied overtime the data sets are clubbed under panel data. Panel data is a special type of pooled data in which the same cross sectional unit is studied overtime and time and categories are variables. In the analysis, years are taken as time variables and industries as categories. For the estimation, Feasible Generalized Least Squares (FGLS) is used as these estimates are more efficient than the OLS estimates (Gujarati, 2004). Under FGLS the disturbances have different variances for each panel and are constant within panel.

- **Model specification**

To avoid the specification bias in the model the first pre-requisite in econometrics is the model specification in single equation models. Model specification is imperative as any violation of this requirement can give imprecise empirical results. To begin with, the correlation matrices for the disputes, strikes and lockouts are given below (table 3.III-1).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Disputes</th>
<th>Strikes</th>
<th>Lockouts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TU</td>
<td>WS</td>
<td>FS</td>
</tr>
<tr>
<td>TU</td>
<td>1</td>
<td>0.1</td>
<td>-0.0</td>
</tr>
<tr>
<td>WS</td>
<td>0.1</td>
<td>1</td>
<td>-0.0</td>
</tr>
<tr>
<td>FS</td>
<td>-0.0</td>
<td>-0.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: TU stands for degree of trade unionization, WS stands for real wages and salaries per worker and FS stands for average factory size.
Table 3.III-2 Determinants of Disputes, Strikes and Lockouts in Overall Period: Total Sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Disputes</th>
<th></th>
<th>Strikes</th>
<th></th>
<th>Lockouts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>Std. Error</td>
<td>Coeff.</td>
<td>Std. Error</td>
<td>Coeff.</td>
<td>Std. Error</td>
</tr>
<tr>
<td>TU</td>
<td>0.22***</td>
<td>0.11</td>
<td>3.56*</td>
<td>0.10</td>
<td>7.11*</td>
<td>0.20</td>
</tr>
<tr>
<td>WS</td>
<td>0.03***</td>
<td>0.02</td>
<td>-0.20*</td>
<td>0.04</td>
<td>0.22**</td>
<td>0.09</td>
</tr>
<tr>
<td>FS</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>D1</td>
<td>9.48*</td>
<td>1.56</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D2</td>
<td>-1.24*</td>
<td>0.30</td>
<td>1.16**</td>
<td>0.46</td>
<td>1.27</td>
<td>1.01</td>
</tr>
<tr>
<td>Constant</td>
<td>3.13*</td>
<td>0.27</td>
<td>0.19</td>
<td>0.49</td>
<td>1.69</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Note: *, **, *** indicates coefficient significant at 1, 5 and 10 percent levels respectively.

For checking the problem of multi-collinearity Karl Pearson correlation has been applied. The table reveals that the correlation between the different variables is less than 0.5. Since there will not be any problem of multi-collinearity, therefore, the testing of the overall periods for disputes, strikes and lockouts can be done. Table 3.III-2 shows that the different independent variables are significant. Hence, the detailed industry wise analysis of incidence, impact and causes of disputes are explained in chapters four and five.