

# Trade Unions' Influence on Wages during 2004/05 – 2011/12: Evidence from NSS Rounds

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*This paper looks into the influence of trade union-membership on wages of their members and also the non-union members in comparison to workers in enterprises without any union during 2004-05 to 2011-12. The findings indicate towards decline in the effectiveness of trade union-membership in enterprises with unions as the real wage gaps and unexplained wage gaps between union and non-union members declined. The relative wages of workers in non-unionized enterprises deteriorated. The effectiveness of trade union-membership on wages declined more in the case of low-wage, low-skill workers indicating declining focus of trade unions on them. Trade unions' influence on wages became even less in public/private limited companies when compared to other enterprises.*

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## Introduction

This paper has two questions to address. The first: how the effect of union-membership on wages has moved over the period 2004/05-2011/12 in the unionised enterprises and whether the trend differs among the occupational categories and with the type of enterprise? The second: how the presence of a union in an enterprise has influenced wages during the period and whether the trend differs among occupational categories and with the type of enterprises?

A few of the case studies have confirmed positive effect of union-membership on wages (Madheswaran & Shanmugam, 2003; Bhandari, 2010). In the background of the findings of a few other studies which found recent trends of declining strength of trade unions due to privatization of the economy, anti-labor policies of the government and declining membership-base of trade unions, it was interesting to look into the influence of union-membership on wages. The database of this paper has been the manufacturing sector workers in India during employment and unemployment surveys in the 61<sup>st</sup> and 68<sup>th</sup> NSS rounds.

The methodologies have been the descriptive statistics, decomposition analysis and multivariate linear regression analysis. The findings confirm decline in effect of union-membership on wages in unionized enterprises, the decline being stronger for low-wage, low-skill workers and in public/private limited companies. But the presence of a union has become more important as wages of non-union members in unionized enterprises have increased relatively more than the workers in non-unionized enterprises during 2004/05 – 2011/12.

### **Background**

A study based on a sample survey of blue-collar male workers in manufacturing industries in Madras district of Tamil Nadu concluded that union members earned around 19% more than non-union members and almost 42% of the wage gap with selectivity bias adjusted was due to discrimination against non-union members (Madheswaran & Shanmugam, 2003). Another study based on field data collected from 271 workers in factories in selected industrial areas of West Bengal, Delhi and Haryana also concluded that the wage premium of union members compared to non-union members was almost 23.5% and around 40% of the wage gap was due to discrimination. Thus the study rejected the free-riding benefits of non-union members in getting the bargained benefits by the union-members (Bhandari, 2010)

A set of case-studies of trade unions working in companies in

Mumbai and nearby found that privatization of public sector companies, outsourcing of production activities, anti-labor policies of the government and increasing flexibility in employment terms were the reasons for the declining base of trade unions (Srivastava, 2006). Another case study conducted in Tata Steel Company by interviewing the white-collar employees found out that management played the major role in recruitment decisions, job assignments and monetary decisions and trade unions had influence only on job security conditions. However the low-skill workers did not feel that trade unions were keen on protecting their jobs (Sarkar & Varkkey, 2008).

Mamkoottam (2006) found that trade unionism was more prevalent among the blue-collar workers before 1970s after which it became stronger among white-collar employees. Another analysis found that during the era of liberalization, privatization and globalization model of growth, the decentralized unions replaced the centralized trade unions affiliated to political parties mainly in newer capital-intensive industries. But the decentralized trade unions could not withstand the resistance of multinational companies in most of the cases (Bhattacharjee, 2000). Although there is evidence of positive impact of union-membership on wages, the case studies indicate declining strength of the trade unions due to several factors. So whether there is decline in the influence of trade unions on wages for the all India sample is an interesting question to look into.

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### Database & Variables

The database used here is the employment and unemployment surveys of 61<sup>st</sup> and 68<sup>th</sup> rounds of National Sample Survey Organization. These are quinquennial surveys that collect data on various socio-economic aspects and the units are the households. The geographical coverage in collecting data has been the whole of Indian union except inaccessible interior places. Various scientific sampling techniques like stratified multi-stage random sampling, simple random sampling without replacement and probability proportional to size with replacement has been applied to select the final households for surveying. So multipliers have been an integral part of the analysis attempted here. The datasets are cross-sectional.

The analysis has been on manufacturing sector industries only. Industrial classification in the 61<sup>st</sup> round (2004-05) has been done on the basis of 1998-NIC code. At two digit level, the manufacturing industries were coded from 15 to 37 according to 1998-NIC code. In the 68<sup>th</sup> round (2011-12) the industrial classification has been done according to 2008-NIC codes and the manufacturing sector industries were coded from 10 to 33. Concordance has been done between NCO code-1968 and NCO code-2004 with some subjective changes.

The definition of formal sector as mentioned in the Factories Act, 1948 has been followed here. The enterprises with 10 or more workers with use of electricity for production purpose or 20 or more

workers without use of electricity for production purpose comprises the formal sector. All other enterprises are considered to be in the informal sector.

The analysis here focused on regular workers in the formal sector. Workers who are considered to be regular according to Usual Principal Status (UPS) have been taken into account for the analysis. UPS shows the main employment status of a person during the reference period of last 365 days.

Dummies were created for general education levels. General education level 1 stands for illiterates and literates without formal schooling. General education level 2 stands for below primary, primary and middle school level of education. General education level 3 stands for the secondary, higher-secondary and diploma courses and level 4 stands for graduate, post-graduate and above levels of education. Age and age-squared were used as proxies for experience level. The wage earnings of the workers has been calculated by dividing total wage and salary earnings received or receivable during a week including cash and kind and then by dividing by total days in that activity during the week in order to arrive at the average daily wage earnings. The real wage earnings are calculated using 2001 base prices. The logarithm of wage level has been used as dependent variable in decomposition analysis and multivariate regression analysis. The enterprises are divided into three groups according to the ownership patterns of the enterprises: group 1 consists of household-managed enterprises, partnership

firms, co-operative societies; group 2 is the public sector enterprises and group 3 comprises the private/public limited companies.

The occupations are divided into three categories. The white-collar occupations include those of managers, legislators, supervisors, directors etc which are comparatively high-wage, high-skill occupations. The pink-collar occupations include those of sales, service workers and clerks which are comparatively low-wage, low-skill categories. The blue-collar occupations include the elementary categories which employ workers without any education formal or otherwise. Descriptive statistics, Neumark decomposition analysis, Machado-Mata decomposition analysis and multivariate regression analysis have been the methodologies used in the analysis.

**Neumark Decomposition Analysis**

Neumark decomposition analysis is basically an advancement based on Oaxaca-Blinder decomposition technique. Oaxaca-Blinder technique is a counterfactual decomposition technique used to study mean outcome differences between groups and is based on linear regression models. The decomposition technique divides mean wage gap of two groups of workers into an explained part and unexplained part. The explained part is the difference in mean wage due to differences in characteristics related to productivity of workers. The unexplained part is treated as discrimination. One shortcoming of the analysis is that the unexplained part also includes difference

in mean wage gap explained by unobserved characteristics and thus tends to often overestimate discrimination.

Explained briefly here is how the decomposition takes place in Oaxaca-Blinder analysis. Suppose there are two groups A and B and the outcome variable is wage. The mean difference in wage between the two groups is noted here by  $W = E(A) - E(B)$ . Further suppose the set of predictors are skill levels and experience level which are denoted by vector  $X$  and the linear regression model is

$$W_i = X_i\beta_i + \epsilon_i \text{ where } i \in (A, B) \text{ and } E(\epsilon_i) = 0.$$

$$W = E(X_a)\beta_a - E(X_b)\beta_b \dots \dots \dots (1)$$

Now if we assume that group B is paid according to the wage structure of group A, then the hypothetical earning function of group B would be:

$$W_b = E(X_b)\beta_a \dots \dots \dots (2)$$

(1) can be rearranged as

$$\begin{aligned} W &= \{E(X_a)\beta_a - E(X_b)\beta_a\} + \{E(X_b)\beta_a - E(X_b)\beta_b\} \\ &= \beta_a \{E(X_a) - E(X_b)\} + E(X_b) \{\beta_a - \beta_b\} \end{aligned}$$

The first part here shows the wage difference which arises if group B is also paid according to the wage structure of group A and this is called endowment effect which happens because of difference in productivity characteristics be-

tween two groups. The second part arises due to difference in the wage structure between two groups. This is the discriminatory part of wage differential.

If we assume here that  $\beta^*$  is a non-discriminatory coefficient structure derived from the pooled coefficient structure where  $\beta^* = \Omega \beta_a + (1-\Omega) \beta_b$  where  $\Omega = (X_a^T X)^{-1} (X_a^T X_b)$  then eq(1) can be arranged as

$$W = \{E(X_a) - E(X_b)\} \beta^* + \{E(X_a) (\beta_a - \beta^*) + E(X_b) (\beta^* - \beta_b)\}$$

Here the first part of the equation i.e.  $\{E(X_a) - E(X_b)\} \beta^*$  is the difference in outcome variable wage which can be explained by differences in predictors. This is the explained part of difference in outcome variable between the two groups. Now the second part arises because of differences in coefficients of the predictors i.e. the difference in returns to endowments. The first component of the second part is due to overpayment made to group A and the second component accounts for the underpayment to group B. However the second part also includes the difference in outcome variable arising for difference in unobserved predictors as already mentioned above. This second part is called the discrimination here. This decomposition is called Neumark decomposition method.

**Mathado-Mata Decomposition Analysis**

The Machado-Mata decomposition technique decomposes the difference in continuous outcome variable between

two groups along the distribution of the outcome variable into explained and unexplained parts. This decomposition method is based on quintile regression models. The description of the methodology assumes that the outcome variable is wage. This technique is based on constructing a counterfactual wage density function where group A's endowments are paid according to coefficient structure of group B.

In this technique firstly m random numbers are drawn from a uniform distribution of [0,1];  $\theta_1, \theta_2, \dots, \theta_m$

- a) For each  $q_i$  where  $i=1, 2, \dots, m$  group A's data is used to estimate the coefficient structure of group A by estimating the quintile regression

$$Q_e(\ln W | X_a) = X_a \beta_a(\theta_i), i=1,2, \dots, m$$

- b) m random draws are made from the co-variates of group A and then the counterfactual values are generated  $\ln W_b^* = X_a^* \beta_b^*(\theta_i)$  and then these values are used to generate the counterfactual wage density function  $f(\ln W; X_a, \beta_b)$

- c) The difference between male and female wage distribution can be written as  $f(\ln W_a - \ln W_b)$  and this is decomposed as

$$f(\ln W_a - \ln W_b) = f(\ln W_a) - f(\ln W_b) = \{f(\ln W_a) - f^*(\ln W; X_a, \beta_b)\} - \{f^*(\ln W; X_a, \beta_b) - f(\ln W_b)\}$$

The first part of this equation is discrimination which is the wage differential which arises if group A members are

paid according to the coefficient structure of group B. The second part of the wage differential is called endowment effect which counts for the wage gap arising due to endowment deficit in group B members.

### Multivariate Regression Model

Multivariate regression analysis has been done to measure the effect on wage level of union-membership in unionized enterprises and the effect on wage level of being in unionized enterprises without union-membership in comparison to workers in enterprises without union. In multivariate regression analysis, logarithm of wage level has been the dependent variable and education dummies for measuring skill level, age and age-squared as proxies for experience level, dummy variables for sector, enterprise type and categorical variables measuring for effect of union-membership and effect of being in an enterprise with union present have been the independent variables. For the categorical variable measuring effect of union-membership, the base category has been workers without union-membership and the other category has been workers with union-membership. For the categorical variable measuring the effect of being in an enterprise with union, the reference category has been workers in enterprises without any union and the other category has been workers without union-membership in unionized enterprises. Testing for multicollinearity and heteroskedasticity has been done.

### Returns to Education

Returns to education of workers have been calculated from the coefficients to general education dummies in multivariate linear regression model. The base category in measuring coefficients to returns to education has been workers without education/formal education level. Returns to education has been calculated for each education level by taking the difference in coefficient to that education level from the coefficient to the earlier education level and then dividing by the difference in years of education between that education level and the earlier level of education. For example if we are to calculate the returns to education to education level 3 then returns to education at education level 3=(coefficient to education level 3 – coefficient to education level 2)/(years of schooling for education level 3 - years of schooling for education level 4)

### Empirical Findings

The wage rate has grown for all workers but the growth rate of wage level has been the highest for non-union-members, followed by that of union-members and lastly workers in enterprises without any union. The wage gap between union-members and non-union members in unionized enterprises and also the discrimination part

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in that wage gap has fallen over the period 2004/05- 2011/12. The wage gap between non-union members in unionized enterprises and workers in enter-

prises without any union increased over 2004/05-2011/12 and a substantial part of that wage gap is discrimination (Tables 1, 2, 3).

**Table 1 Real Wage Growth (in % terms), Mean Real Wage Levels (in rupees) for Workers with Union Membership, Workers without Union-Membership in Enterprises with Unions and Workers in Enterprises without Union**

Year	Workers with Union Membership	Workers in Unionized Enterprises without Union-Membership	Workers in Enterprises without Any Union
Real Wage Growth	30.13	69.72	18.08
2004-05	197.71	104.66	131.58
2011-12	257.29	177.63	155.38

**Table 2 Discrimination Level (in % terms) and Real Wage Gap (in rupees) between Workers with Union Membership and without Union Membership in Enterprises with Unions**

Year	Discrimination level	Real Wage gap
2004-05	41.81	93.05
2011-12	6.75	79.66

**Table 3 Discrimination Level (in % terms) and Real Wage Gap (in rupees) between Workers without Union-Membership in Unionized Enterprises and Workers in Enterprises without Any Union**

Year	Discrimination level	Real Wage gap
2004-05	-171.38	-26.92
2011-12	68.68	22.25

For white-collar workers wage growth had been marginally higher for union members than for non-union-members in unionized enterprises. For both pink-collar and blue-collar workers, wage growth has been much higher for non-union members than for union-members in unionized enterprises. Thus during

**For both pink-collar and blue-collar workers, wage growth has been much higher for non-union members than for union-members in unionized enterprises.**

2004/05-2011/12, decline in wage gap between union-members and non-union members in real terms had been high for blue-collar workers whereas the wage gap increased for white-collar workers (Tables 4, 5, 6). Along with the decline in wage gap between union and non-union members over time, there happened a decline in wage discrimination between union and non-union members in unionized enterprises for workers in all occupations. The decline in wage discrimination level is also higher among blue-collar workers compared to white-collar workers (Tables 7, 8, 9)

**Table 4 Real Wage Growth (%) , Mean Wage Levels ( in rupees) for Workers with Union Membership, Workers without Union-Membership in Enterprises with Unions and Workers in Enterprises without Union for the White-collar Workers**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Real Wage Growth	52.73	48.38	-11.17
2004-05	380.6	258.25	429.3
2011-12	581.29	383.19	381.35

**Table 5 Real Wage Growth( %) , Mean Wage Levels ( rupees) for Workers with Union Membership, Workers without Union Membership in Enterprises with Unions and Workers in Enterprises without Union for the Pink-collar Workers**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Real Wage Growth	10.78	16.03	14.81
2004-05	206.33	147.96	149.36
2011-12	186.25	171.68	171.48

**Table 6 Real Wage Growth (%), Mean Real Wage Levels ( rupees) for Workers with Union Membership, Workers without Union Membership in Enterprises with Unions and Workers in Enterprises without Union for the Blue-collar Workers**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Real Wage Growth	7	77.50	40.48
2004-05	160.07	79.05	80.02
2011-12	171.29	140.32	112.41

**Table 7 Discrimination Level (in % terms), Real Wage gap and Real Wage Gap due to Discrimination (in rupees) between Workers with Union Membership and Workers without Union Membership in White-collar Occupations**

Year	Discrimination Level	Wage Gap in Real Terms	Wage Gap Due to Discrimination
2004-05	85.01	122.35	104.01
2011-12	56.69	198.1	112.30

**Table 8 Discrimination Level (%), Real Wage Gap and Real Wage Gap due to Discrimination (rupees) between Workers with Union Membership and Workers without Union Membership in Pink-collar Occupations**

Year	Discrimination Level	Real Wage Gap	Real Wage Gap Due to Discrimination
2004-05	43.46	58.37	25.37
2011-12	12.97	14.57	1.89

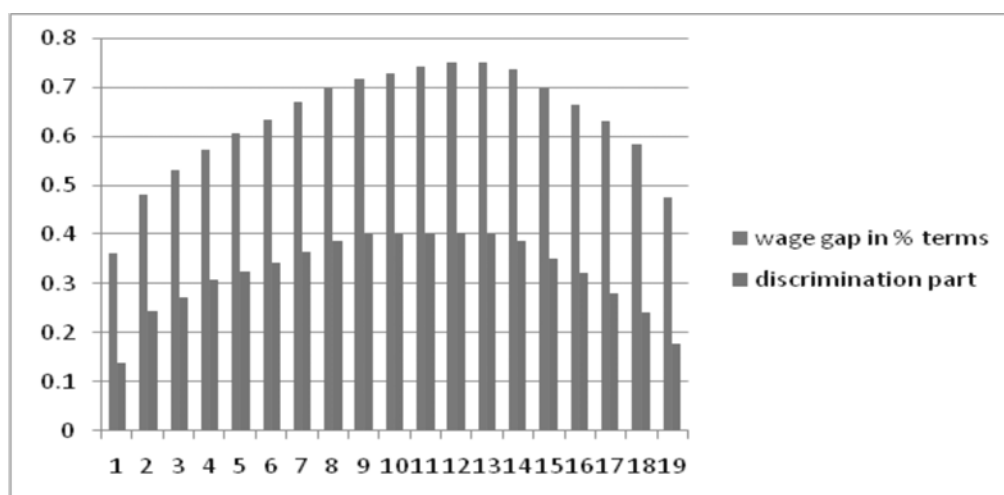
**Table 9 Discrimination Level (%), Real Wage Gap and Real Wage Gap Due to Discrimination (rupees) between Workers with Union Membership and Workers without Union Membership in Blue-collar Occupations**

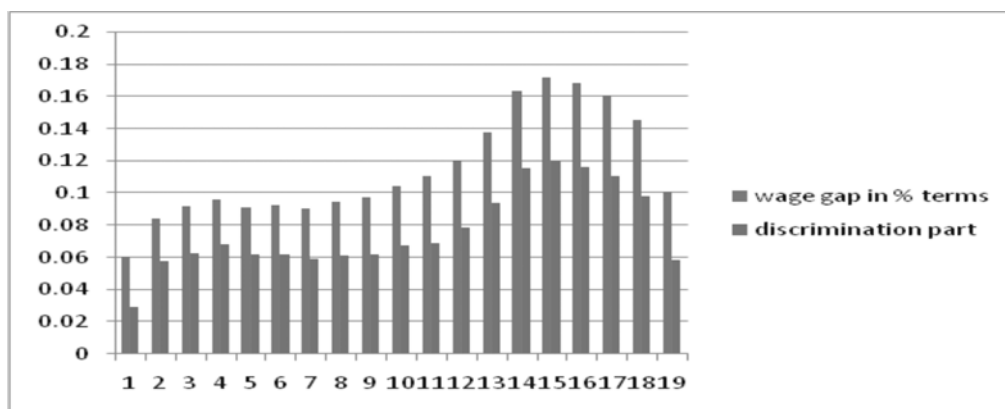
Year	Discrimination level	Real Wage Gap	Real Wage Gap Due to Discrimination
2004-05	50.65	81.02	41.04
2011-12	-4.64	30.97	-1.44

Along the wage distribution wage gap (in % terms) and discrimination part in that wage gap between union-members and non-union members have fallen more at lower wage levels. This result is quite consistent with the earlier results of high fall in wage gap between union

and non-union members among pink-collar and blue-collar workers and rise in that wage gap for white-collar workers and higher fall in discrimination level in the case of blue-collar workers compared to white-collar workers (figs.1, 2, Tables 1, 2 in Appendix).

**Fig.1 Wage Gap ( in logarithmic scale) and Discrimination Level ( % between the Union Members and Non-union Members along the Wage Level in 2004-05**



**Fig.2 Wage Gap (in logarithmic scale) and Discrimination Levels ( %) between the Union Members and Non-union Members along the Wage Level in 2011-12**

The wage growth rate of workers in enterprises without any union has been lower than that of non-union members in unionized enterprises for all occupations (Tables 4, 5, 6). The increase in real wage gap between non-union members in unionized enterprises and workers in enterprises without any union has been higher for white-collar workers than for blue-collar and pink-collar workers. The decline in wage gap between non-union members

and union-members and increase in wage gap between non-union members and workers in enterprise without any union have been high in group 3 enterprises whereas it stayed almost the same in group 1 enterprises (Tables 13, 14, 15). The major difference in changes in wage levels for workers in different occupations is that the relative improvement of non-union members took place mainly for the pink-collar and blue-collar workers.

**Table10 Discrimination Level (%), Real Wage Gap and Real Wage Gap due to Discrimination (rupees) between Workers without Union Membership in Unionized Enterprises and Workers in Enterprises without Any Union in Case of White-collar Occupations**

Year	Discrimination Level	Real Wage Gap	Real Wage Gap Due to Discrimination
2004-05	84.41	-171.05	-144.38
2011-12	66.66	1.84	1.23

**Table11 Discrimination Level (%), Real Wage Gap and Real Wage Gap due to Discrimination (rupees) between Workers without Union Membership in Unionized Enterprises and Workers in Enterprises without Any Union in Case of Pink-collar Occupations**

Year	Discrimination Level	Wage Gap in Real Terms	Wage Gap Due to Discrimination
2004-05	-230.39	-1.4	3.23
2011-12	-97.2	0.2	-0.2

**Table 12 Discrimination Level ( %), Real Wage Gap and Real Wage Gap Due to Discrimination (rupees ) between Workers without Union Membership in Unionized Enterprises and Workers in Enterprises without Any Union in case of Blue-collar Occupations**

Year	Discrimination level	Wage Gap in Real Terms	Wage Gap Due to Discrimination
2004-05	-272.3	-0.97	2.64
2011-12	77.4	27.91	21.6

**Table 13 Wage Growth (%) Mean Real Wage Levels (rupees) for Workers with Union Membership, Workers without Union Membership in Enterprises with Unions and Workers in Enterprises without Union in Group1 Enterprises**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Wage growth	35.43	39.02	38.41
2004-05	116.56	81.15	89.42
2011-12	157.86	112.82	123.77

**Table 14 Wage Growth (%), Mean Real Wage Levels (rupees) for Workers with Union Membership, Workers without Union Membership in Enterprises with Unions and Workers in Enterprises without Union in Group2 Enterprises**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Wage growth	60.47	86.76	43.43
2004-05	328.32	159.67	212.52
2011-12	526.87	298.20	304.82

**Table 15 Wage Growth (%) Mean Real Wage Levels (rupees) for Workers with Union Membership, Workers without Union Membership in Enterprises with Unions and Workers in Enterprises without Union in Group 3 Enterprises**

	Workers with Union-Membership	Workers in Unionized Enterprises without Union-membership	Workers in Enterprises without Any Union
Wage growth	23.89	59.76	-3.84
2004-05	190.46	119.74	198.34
2011-12	235.97	191.30	190.72

The regression results confirm that the effect of union membership has fallen over the period 2004/05-2011-12 on wage level in unionized enterprises in all occu-

pations. The regression results also confirm that positive effect of being in a unionized enterprise even without union membership compared to workers in en-

**Effect of union membership has fallen over the period 2004/05-2011-12 on wage level in unionized enterprises in all occupations.**

terprises without any union increased over 2004/05-2011/12 in all occupations. The magnitude of decline in positive ef-

fect of union membership in unionized enterprises and increase in effect of being in unionized enterprise even without union membership compared to workers in enterprises without union are higher in group 3 enterprises. The decline in positive effect of union membership has been more for pink-collar and blue-collar workers compared to white-collar workers (Tables 16, 17).

**Table 16 Effect of Union Membership on the Wage Level during 2004/05 -2011/12**

	Effect of being in an union in 2004-05	Effect of being in an union in 2011-12
For all the workers	0.21	-0.03
For workers in group1 enterprises	0.21	0.12
For workers in group2 enterprises	0.38	0.34
For workers in group3 enterprises	0.15	-0.11
For the white-collar workers	0.32	0.14
For the pink-collar workers	0.27	-0.03
For the blue-collar workers	0.27	-0.03

**Table17 Effect of Being in an Enterprise with Union even without Union-membership during 2004/05 -2011/12**

	Effect of being in an enterprise even without union membership compared to those in enterprises without any union in 2004-05	Effect of being in an enterprise even without union membership those in enterprises without any union in 2011-12
For all Workers	-0.01	0.14
For Workers in Group 1 Enterprises	-0.03	-0.02
For Workers in Group 2 Enterprises	0.18	0.09
For Workers in Group 3 Enterprises	0.04	0.16
For White-collar Workers	-0.20	0.06
For Pink-collar Workers	0.10	0.03
For Blue-collar Workers	0.04	0.18

### Difference in Wage Determination

Returns to education has been more at lower levels of education for union-members and higher at highest level of education for non-members in 2004-05

**Returns to education increased at lower levels of education among non-union members and declined at highest level of education.**

in unionized enterprises. In 2011-12, gap in returns to education between union members and non-union members increased marginally at education level 2 in unionized enterprises. At education level 3, returns to education increased for non-union members sharply and it became much higher for non-union members compared to union-members. At highest level of education, returns to education declined sharply among non-union-members and went up to some extent among

union-members. On the whole, returns to education increased at lower levels of education among non-union members and declined at highest level of education in comparison to union-members (Tables 18, 19). This result is consistent with the earlier results of higher decline in effect of union membership and sharper decline in the wage discrimination level against the non-union members among the pink-collar and blue-collar workers compared to that of the white-collar workers.

**Table 18 Returns to Education for Workers with Union Membership and for Workers without Union Membership in 2004-05**

	Workers with Union Membership	Workers without Union Membership
General Education level2	0.068	0.046
General Education level3	0.066	0.02
General Education level4	0.088	0.16

**Table 19 Returns to Education for Workers with Union Membership and for Workers without Union Membership in 2011-12**

	Workers with Union Membership	Workers without Union Membership
General Education level2	0.044	0.012
General Education level3	0.061	0.11
General Education level4	0.12	0.096

### Concluding Remarks

Our findings are in support of those of the case-studies which found that there was a decline in the bargaining strength of the trade unions in ensuring better wages to the union-members. However, the relative deterioration in

**There was a decline in the bargaining strength of the trade unions in ensuring better wages to the union-members.**

wages of workers in non-unionized enterprises compared to the non-union members in unionized enterprises indicate towards increasing importance of a union in an enterprise. The decline in the effect of union-membership being more in case of blue-collar and pink-collar occupations indicates towards declining focus of trade unions on low-wage, low-skill workers.

The higher decline in the influence of union-membership on wages in public/private limited companies indicates

towards the inability of trade unions to resist the strength of these enterprises.

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### Appendix

**Appendix Table 1 Machado-Mata Results between Union Members and Non-union Members in 2004-05 (wage level in logarithmic scale)**

	Predicted Wage Gap	Explained Part	Unexplained Part
<u>1</u>	0.36	0.22	0.14
<u>2</u>	0.48	0.24	0.25
<u>3</u>	0.53	0.26	0.27
<u>4</u>	0.57	0.26	0.31
<u>5</u>	0.61	0.28	0.33
<u>6</u>	0.64	0.29	0.34
<u>7</u>	0.67	0.31	0.36
<u>8</u>	0.70	0.31	0.39
<u>9</u>	0.72	0.32	0.40
<u>10</u>	0.73	0.33	0.40
<u>11</u>	0.74	0.34	0.40
<u>12</u>	0.75	0.35	0.40
<u>13</u>	0.75	0.35	0.40
<u>14</u>	0.74	0.35	0.39
<u>15</u>	0.70	0.35	0.35
<u>16</u>	0.67	0.34	0.32
<u>17</u>	0.63	0.35	0.28
<u>18</u>	0.59	0.34	0.24
<u>19</u>	0.48	0.30	0.18

**Appendix Table 2 Machado-Mata Results between Union Members and Non-union Members in 2011-12 (Wage level in logarithmic scale)**

	Predicted Wage Gap	Explained Part	Unexplained Part
1	0.061	0.031	0.030
2	0.084	0.026	0.058
3	0.092	0.030	0.063
4	0.096	0.028	0.068
5	0.091	0.029	0.062
6	0.093	0.031	0.062
7	0.090	0.031	0.059
8	0.095	0.034	0.061
9	0.097	0.035	0.062
10	0.104	0.037	0.067
11	0.111	0.042	0.069
12	0.121	0.042	0.079
13	0.138	0.044	0.094
14	0.164	0.048	0.116
15	0.172	0.052	0.120
16	0.169	0.052	0.117
17	0.161	0.050	0.111
18	0.146	0.048	0.098
19	0.101	0.043	0.058

**Appendix Table 3 Tests for Heteroskadasticity for the Linear Regression Models Over Time**

Regression model:

Dependent variable: log of wage

Independent variables: General Education 2, General Education 3, General Education 4, Age, Age-Square, Union Membership, Sector, Sex, Enterprise Type

	Test statistics(chi-square)	Prob > chi-square
2004-05	2088.21	0.0000
2011-12	208679.54	0.0000

The assumption of homoskadasticity holds here.

**Appendix Table 4 Tests for Heteroskadasticity for the Linear Regression Models Over Time**

Regression model:

Dependent variable: log of wage

Independent variables: General education 2, General Education3, General Education 4 , Age, Age-Square, Being in an Enterprise with Union, Sector, Sex, Enterprise Type

	Test Statistics (chi-square)	P-value
2004-05	287553.03	0.0000
2011-12	830373.83	0.0000

The assumption of homoskadasticity holds here.

**Appendix Table 5 Tests for Multi-collinearity for the Linear Regression Models Over Time**

Regression model:

Dependent variable: log of wage

Independent variables: General Education 2, General Education3, General Education 4, Age, Age-Square, Union Membership, Sector, Sex, Enterprise Type

Variables	VIF (2004-05)	VIF (2011-12)
General education 2	3.8	3.86
General education 3	4.03	4.59
General education 4	3.03	3.8
Age	44.05	51.85
Age-square	43.61	51.08
Union-membership	1.12	1.03
Sex	1.09	1.1
Sector	1.08	1.16
Enterprise-type1	2.41	2.77
Enterprise-type3	2.25	2.78

In the regression model multi-collinearity is a problem only for age and age-square but keeping in mind the relevance and significance of the non-linear relation of age with wage level, both the variables are retained here.

**Appendix Table 6 Tests for Multi-collinearity for the Linear Regression Models Over Time**

Regression model:

Dependent variable: log of wage

Independent variables: General Education 2, General Education3, General Education 4, Age, Age-Square, Being in an Enterprise with Union, Sector, Sex, Enterprise Type

Variables	VIF (2004-05)	VIF (2011-12)
General education 2	2.9	3.06
General education 3	2.77	3.07
General education 4	2.27	2.28
Age	33.49	35.16
Age-square	33.19	34.83
Union-membership	1.05	1.03
Sex	1.05	1.07
Sector	1.02	1.07
Enterprise-type1	11.95	16.27
Enterprise-type3	11.74	16.06

In the regression model multi-collinearity is a problem for age, age-square and the types of enterprises. But keeping in mind the relevance and significance of the variables these are retained in the regression model.