Chapter VI

Summary and Conclusion

In the preceding chapters, attempts have been made to analyse the labour market behaviour of science graduates in India. We analysed the relationship between education and earnings, earnings differentials by sex, caste and sector. This chapter summarises the result of the analysis. The discussion of this chapter proceeds as follows: Section 6.1 presents the summary and major findings. The empirical results are compared, wherever possible, with other country settings. Some policy implications of this study are presented in section 6.2. The limitations of the present study are also mentioned in section 6.3. Suggestions for further research are given in section 6.4.

6.1 Summary and Major Findings

Since independence, the expansion of higher education in India has been unprecedented; the same phenomenon has also been observed in the case of scientific and technical education. This expansion has resulted in rapid growth of scientific manpower. Concomitantly, the size of the educated unemployed persons have been increasing. There is a mismatch between supply of and demand for persons with various types of skills. Given this mismatch, a question arises why do individuals as well as government spend so much on education when the prospects of employment after schooling looks so unpromising? The present study attempted to give an answer. Assuming education as an investment, we attempted to analyse the labour market with the following objectives: (i) Does education contribute positively to earnings? What are the rates of return to education? How does it do so? That is, whether education augments productivity or serves only as a screening device?; (ii) If the return to education is substantial, is it equally profitable to groups of population classified by sex, caste and sector of employment?; (iii) What are the determinants of, and their effects on, the choice of sector? Is the sector choice in the labour market related to earnings?

We utilised an all India science graduates sample drawn from DHTP-1981 survey data. In the first chapter, we have discussed the overview of the labour market for scientific and technical personnel using descriptive analysis. The education pattern
shows that women opt for selected few educational disciplines compared to men. The labour market participation of women is quite low and the degree of unemployment among them is high relative to men. Earnings differential do exist between men and women scientific and technical personnel and it is large in the private sector.

In chapter II, the relationship between education and earnings has been analysed. A brief review of literature and some econometric problems in the estimation of earnings function were presented. As a first step of empirical analysis, descriptive cross-tabulations like distribution of earnings, age/experience-earnings profiles, present discounted value of life time earnings and inequality measures are presented to study the structure of earnings and the observed positive association between education and earnings. The results clearly exhibit that:

(i) More females are in lower earnings classes and the private sector workers are more represented in the upper earnings classes compared to their counterparts.

(ii) In all age/experience groups, the mean earnings of males, non-SC/ST, private sector employees are, on the average, higher compared to their counterparts.

(iii) Higher the educational level, higher the mean earnings.

(iv) Earnings rise with academic performance and quality.

(v) Relative ranking of the level of education with respect to PDV does not change much when alternative discount rates are used.

(vi) Earnings inequality is higher among males, non-SC/ST and private sector workers compared to their counterparts; among the levels and types of education, the inequality is larger for UG and few science subjects.

In the second step, the validity and specification of earnings functions are verified using Box-Cox non-linear regression. The results confirm that semi-logarithmic form is the appropriate functional form and the diagnostics of the OLS properties also hold good for semi-logarithmic function. Then we analysed the factors that influence first earnings and current earnings of science graduates. In the analysis of first earnings, an
attempt was made to study the impact of job search and other factors such as division obtained in the examination, country of graduation and the year of graduation on first earnings. From the results, we observed that recent cohorts fare uniformly better than older cohorts; there are increasing returns to job search, implying that job search rewards to graduates in India.

In the analysis of current earnings, the focus was on the rates-of-return to education and the identification of the factors that determine the current earnings. We estimated both basic and extended human capital models for gender, caste and sector. The selectivity bias problem has also been addressed using Heckman-two step procedure. The lambda is significant in almost all the equations which confirms that there exists selectivity bias. The double selectivity problem like report inclination/labour force participation and sector choice/labour force participation has also been taken into account; the lambda from the two choice equations are significant and suggest the need for selectivity bias correction in the earnings function.

The results of the analysis of current earnings are summarised as follows:

(i) The calculated rates of return from the basic human capital model are upwardly biased when we compare the rates of return calculated from the extended model. This may be due to exclusion of factors like ability, quality of education, etc. in the former.

(ii) The rates of return to female and SC/ST education are higher than those for male and non-SC/ST education. This result is similar to the findings from other developing countries. The higher rates of return for females may be due to factors such as higher interest cost of resources for schooling investments and high risk premia for investing in schooling of females.

(iii) The rates of return to education of private sector employees are higher than that of public sector workers after selectivity correction. This result also corroborates with other developing country results; the higher return in private sector suggests the productivity enhancing role of education.

(iv) The division obtained in the examination has significant influence in both first
and current earnings equations; a first division in the graduating examination has a definite premium over the second and third divisions. Further, foreign degree is also rewarded better vis-a-vis Indian degree.

(v) The influence of marital status is mixed; being married has some influence on current earnings in male equation whereas it is insignificant in female equation.

(vi) The vintage variables on current earnings showed a negative trend implying that later vintages earn less and also the omission of vintage variables in the earnings function impart an upward bias in the estimation of experience-earnings profile.

(vii) The comparison of first earnings and current earnings equations show that division and foreign degree have greater influence on current earnings than first earnings. Further these variables are also positive and significant in the equation for growth of earnings.

(viii) The division, foreign degree and marital status are the other major determinants of the earnings, as reflected by the coefficients of determination ($R^2$). Thus, the major conclusion of this chapter is that acquiring education is profitable to educated ones; acquiring better quality education is also profitable.

Chapter III addressed the principle issue whether education is an investment or screening device in the labour market? We reviewed theoretical and empirical studies that used a variety of tests on the screening hypothesis. Then we employed some of these tests and the results are summarised as follows:

(i) The estimated rate of return to education is higher in self-employed sector than the private and wage employed sector (combining public and private sector).

(ii) The calculated PDV is higher for private sector than the self-employed, which is contrary to the Riley and Anup Shah results.

(iii) The decomposition of gross earnings differential between private sector and self-employed into constant term, endowment and coefficient differences show a greater mean endowment difference; particularly the contribution of education is more for self-employed.
(iv) The earnings function and mid-to-early career earnings ratios for public and private sectors are estimated. It shows that rates of return to education are higher for competitive sector (private) after correction for selectivity bias; however, a clear picture does not emerge from the differential earnings growth. Thus, the results of this chapter, by and large, fail to support screening hypothesis.

In chapter IV, an attempt has been made to analyse earnings differentials by sex and caste. Here also we reviewed the theoretical and empirical studies that used various methodologies to estimate the extent of discrimination. The results of the empirical analyses are summarised as follows:

(i) Sex-wise employment probabilities show that the females are not favoured.

(ii) The mean labour force participation of female is low compared to male. The variables like age, level of education, division and foreign degree have significant impact on labour force participation of males and females. Married women are less likely to participate while married men are more likely to work. Among the variables, education has a very significant impact on female labour force participation. The implication is that education increases women's labour market participation probability.

(iii) The calculated female-male earnings ratio by age, experience and occupation groups clearly demonstrate that the female workers earn only a part of the male earnings, the female-male earnings ratio being less than one.

(iv) The Chow test rejected the null hypothesis that the earnings structure are the same for men and women. Then we used the decomposition methods suggested by Oaxaca, Cotton, Neumark and Brown, et. al., to decompose the gross earnings differentials into explained and unexplained portions.

(v) The average monthly earnings of males and females are Rs.1057 and Rs.856 respectively. The gross unadjusted difference is Rs.201, in favour of males. The results of Oaxaca method showed that nearly 72 percent (two-third) is due to differences in human capital endowments and 28 percent due to discrimination.
The result is in conformity with the other empirical studies that have shown that the endowment difference plays a major part in explaining earnings differences by sex in less developed countries and that the proportion of discrimination is lower in developing countries relative to developed countries. The most interesting observation is that India has one of the smallest discrimination coefficient compared to international levels (Table 4.5).

(vi) A similar exercise has also been carried out to find the extent of discrimination within public and private sectors. There is a large male-female gross earnings differential of Rs.356 in private sector compared to Rs.152 in the public sector. Although legislative measure and social development policies are implemented by the government, substantial earnings differential do exist in the public sector.

(vii) The decomposition estimates are sensitive to the specification of the earnings function and selectivity bias. For instance, when types of education are used instead of levels of education, the discrimination coefficient gets reduced. The discrimination coefficient also decreases when selectivity corrected equations are used for the decomposition.

(viii) The results of the relative contribution of each variable to the decomposition suggest that the large positive contribution of constant terms offset the negative contribution of sector and other variables. Therefore, the difference in constant terms requires much more explanation than other variables. Firstly, the constant term represents the "reward to the sex of the worker" when all other characteristics are held constant. However, we are not prepared to say that the difference in constant terms represent actual discrimination because information is lacking. In particular, the constant terms are affected by factors pertaining to both labour demand and labour supply. With respect to labour demand, one can mention genuine differences in productivity between the sexes or imperfect information, while on the supply side there may be genuine differences in tastes of women and men. Secondly, the constant terms can be seen as pure premia that are independent of workers' other wage determining characteristics. This interpretation may be relevant to our findings. Hence, the constant terms remain a black box.
within the black box of unexplained residual. Next to the constant terms, education and experience are other important observed characteristics which give more contribution to the males pay advantage.

(ix) To overcome the index number problem inherent in Oaxaca method, Cotton method has been used. Unlike the standard decomposition, this method used the labour force proportion as a weight to calculate the non-discriminatory wage structure and provide three components. The results show that the difference due to skill is 68.73 percent, male treatment advantage component is 6.40 percent and female treatment disadvantage component is 24.87 percent, using the selectivity corrected equations. The discrimination coefficient obtained by combining the latter two components is slightly higher than Oaxaca method. Further, we also used sample cross product matrix as a weight to calculate the non-discriminatory wage structure following Neumark. The calculated discrimination coefficient according to this method is lower than the coefficients of both the Oaxaca and Cotton methods. It gives the combined effect of pure nepotism and pure discrimination.

(x) Standard errors were calculated for the discrimination coefficients obtained from Oaxaca, Cotton and Neumark methods for comparison purpose. It seems that the Neumark method is least objectionable compared to other two methods, the standard error being the smallest.

(xi) A separate account has also been made to analyse the interaction between occupational attainment and the wage differential using Brown, et.al., method. Studies of this type for developing countries are less frequent and almost non-existent in India. This analysis revealed that intra-occupational wage effects are more pronounced than inter-occupational wage effects. Secondly, as regards the unjustifiable wage effects, discrimination within occupation is far more important than discrimination in occupational attainment. The estimated results are consonant with other studies (Table 4.7 provides a comparison).

(xii) To counter the shortcomings of the decomposition methodology, an alternative approach, that is, frontier function approach, has also been suggested. We considered the whole distribution of logarithmic earnings instead of comparing the average
characteristics of men and women as frequently followed in the decomposition technique. The empirical results are given in the appendix of this chapter. This method involves the estimation of an earnings frontier for females that depends on their marginal productivity. Discrimination here is measured as the amount of female earnings removed from the frontier, less any labour market inefficiency. Our estimated result shows that the expected value of the half-normal error term is -24 percent. It means that on average female monthly earnings are reduced by a maximum of 24 percent from the frontier; for males, the expected half-normal term is -16 percent which is less than that of females. It indicates that the reason for earnings differential may either lie in the functioning of the labour market and women’s choice or in both.

(xiii) We also looked at the earnings differential by sex, caste and sector from an angle different from the taste for discrimination. Market information (ignorance) has been recognised as a source of earnings differential and it is attributed to the information deficiencies from either employee or employer. A two-tiered earnings frontier method was used; the estimation and empirical results are given in the appendix of this chapter. The estimated results show that male, non-SC/ST and public sector workers have more labour market information than their counterparts. Though the magnitude of the results changes, they are in line with the results derived above.

The objective of the second part of chapter-IV is to measure the extent of discrimination by caste, and then to explain the reason for, and the mechanism of, discrimination. The methodology used is the same as in the previous part. Use of the standard method of decomposition show that there is indeed discrimination by caste, but lower than the discrimination by sex. Our explanation of discrimination against SC/ST are suggestive rather than conclusive. We cannot, for instance, rule out the possibility that caste is simply acting as proxy for unmeasured differences in productivity. The theory based on ‘taste for discrimination’, therefore appears relevant to this study. An interesting finding is that the calculated discrimination coefficient is negative (-1.01 percent which favours SC/ST) in public sector whereas its magnitude is positive and
higher in the private sector. This indicates that the reservation policy implemented by
government has been effective. Our attempt to distinguish between job and wage dis-
crimination through the estimation of occupational attainment function suggests that
the latter is quantitatively more important which is in line with the findings of Banerjee
and Knight (1985) for India.

In chapter V, an attempt has been made to analyse the earnings differential between
public and private sectors. A brief review of empirical studies are made. The following
are the major findings:

(i) The public-private sector earnings ratio in different age and experience groups
clearly demonstrate that the public sector workers earn only a part of the private
sector workers, one notable exception being the mean earnings of the PG (and
above) graduates in the public sector whereas UG graduates are paid more in the
private sector.

(ii) Separate earnings functions were fitted for public and private sectors with and
without selectivity correction. Similarly, earnings functions were fitted separately
for gender and caste within the two sectors. Regarding rates of return to education,
earlier studies report that the return in the private sector exceed those in the
public sector. We found an opposite picture using OLS method; the results after
selectivity correction show that the returns to education in private sector are
higher compared to public sector. It implies that there is a need for selectivity
bias correction while estimating earnings functions for the sectors.

(iii) The Chow test value was highly significant; it implies that there is a significant
difference in wage determination between the sectors.

(iv) The average monthly earnings of science graduates was Rs.1009 in the public
sector and Rs.1117 in the private sector with a gross unadjusted difference of
about Rs.108 or 10.7 percent in favour of the private sector. In the same way, the
calculated difference was 13.13 percent (Rs.134) for males, 10.09 percent (Rs.102)
for non-SC/ST and 4.4 percent (Rs.39) for SC/ST in favour of private sector;
whereas this difference was 8.5 percent (Rs.61) in favour of females in the public sector.

(v) The standard decomposition exercise show that the endowment difference and economic rent (quasi rent/surplus payment) are in favour of private sector except for females and SC/ST.

(vi) The application of Reimer's method show that selectivity (unobserved difference) lowers the earnings gap between public and private sectors. This result also suggests that the difference in constant terms are the most important determinant of earnings differentials between the sectors rather than coefficient differences.

(vii) The sector choice has been analysed using two-stage probit method. The coefficient of Ph.D and PG are positive and significant in the choice equation while the coefficient of UG is negative and significant. The result supported that the higher level of education are associated with a greater probability of government employment. It implies that public sector provides extra rewards for these workers through either higher wages or other job characteristics. Although private sector pays more, the coefficient of wage differential in the choice equation clearly shows that there is a significant increase in the probability to work in the public sector. This substantiates the original suspicion that workers make choice based on the net advantage. We have also found that the public sector is more effective at internally enforcing its employment guidelines for protected groups - female and SC/ST - compared to private sector.

(viii) A separate account has been made to investigate the earnings differential between the sectors (for a post graduates sample) using switching regression method. Since the switching regression requires considerable time to converge, we could not apply this method to the total sample. Another reason is that the public sector pays more to the post graduates than private sector. The endogeneous switching regression result showed that the OLS estimation is biased and the individual's predicted earnings differential between the sectors have a significant effect on the individual's sectoral choice. Comparison of predicted earnings revealed that public sector workers earn more in the public sector than private sector workers would
have done, and vice versa, and that private sector workers perform better in the private sector than public sector workers would have done. Thus, our results point to the presence of absolute sector advantage.

Thus this research work shows that the labour market for science personnel in India is not competitive. Even in this non-competitive market situation there are positive returns for human capital investments.

6.2. Policy Implications

We are reluctant to discuss the policy implications of this empirical study as the data refers to a single point of time and focused only on the labour market for science graduates. Replication of such labour market analysis over space and time only provide robust results from which one can derive definite policy implications.

The regression results of earnings function suggest that (i) investment in raising the quality of schooling is more profitable than quantitative expansion; (ii) investment in information dissemination about supply and demand for graduates with various type/level of schooling would be profitable. The policy should aim at more on quality aspects of education and encourage information flow.

The results of analyses of earnings differentials by sex and caste suggest that the market rewards for education is not discriminatory against women and SC/ST, but the usual market discrimination coefficient as calculated in the literature shows discrimination against women and SC/ST. We find it hard to suggest policy to reduce the market discrimination; but when we look at the contribution of various factors to discrimination, the policy should aim more at the household distribution of resources to education of boys and girls; SC/ST family should also be encouraged to invest in children. In practice, much of the discrimination may have become institutionalised as a result of stereotyping of women's roles within society. Therefore, the radical changes in social behaviour and social values attached to the weaker sections family will be necessary before it is possible to even up the imbalance in the earnings and occupational structure of gender and caste. The policy of reservation seems to have the desired effect but how it would be extended to private informal and self-employed sectors needs deliberations.
The results of earnings differentials by sector suggest that, on average, private sector offers a higher wage than the public sector, whereas the result of mean earnings by level of education within sector shows that public sector offers higher wages for post graduates. This indicates that the government should collect information on earnings and other personal characteristics of workers in both the public and private sectors for formulating fair wage structure and parity of earnings between the sectors.

6.3 Limitations of the Study

The limitations of the study have been pointed out in several stages in the relevant contexts. To repeat, one important limitation of the present study is that it has not been possible to link the findings with the stock of scientists available in the country. Unfortunately, there are no reliable estimates of stock of science graduates disaggregated by specialization for various years. If this was available, it would have been possible to combine the data to study the relationship between stock, supply and earnings of science graduates. Possibly, this is likely to produce more robust estimates of the results found in this dissertation. Secondly, our data set does not have information on hours of work, family background, unionisation and tenure of the job. This is an important limitation from the point of view of analysing equity effects of education. It may be asked: Who spends longer time in job search? Who accepts a job as soon as it is available? The answer to these questions form important links concerning equity in education and are absent in the present analysis.

The discrimination measure may be an underestimate or overestimate of the true level of discrimination to the extent that relevant productivity variables have been excluded from the earnings function, and variables that are endogeneous to discrimination have been included. Factors that affect the earnings that are quite different between the sexes such as workers’ innate ability, commitment to the labour force, quality of educational institute and union membership have not been included which could probably overestimate the discrimination component. On the other hand, an underestimation of discrimination level is also possible since the labour market experience has been included in the earnings equation which may well be endogeneous to the process of discrimination. Further, the data used only a single digit classification of occupation; a
more detailed stratification would help in computing accurate occupational segregation indices. It must also be mentioned here that in any study making use of decomposition of earnings equations, the results depend on the specification of the equation. While the approach of the present study may be justified on theoretical grounds, we do readily acknowledge the existence of alternative specifications and approaches.

The estimated earnings differential by sector is based on comparison of all science graduates employed in the public and private sectors allowed us to take advantage of applying similar scales for the whole of public and the whole of private sectors; however, due to data limitations we have not been able to account for variations across the levels of employment in government-central, state, municipal/local bodies and public sector undertakings. Nor has it been possible to include any estimation of the advantages through compensation and their relative impact on wage differential between the two sectors. Furthermore, we have not included regional variations to focus the impact of location or occupational wage differences to compare the differential implications of career paths for wage attainment in the two sectors.

6.4 Suggestions for Further Research

One may suggest a good number of problems for further investigation. However, we constrain ourselves to a few which we think will be of value for understanding earnings differentials by gender and caste.

The decomposition of earnings differential by sex/caste with a view to estimate the value of discrimination coefficient shows in our study, as well as other studies, that differences in human capital between male and female workers play a greater role than market discrimination coefficient which is really a residual to account for the earnings differentials. When better data set and more efficient methods are available, the value of the residual is more likely to diminish, as in the case of Denison's work on growth. We suspect that pre-market discriminatory practice in the family with respect to education, health and nutrition is more crucial than market discrimination. It seems more useful to devote greater effort to understand intrafamily resource allocation to sons and daughters.
We have used three alternative hypotheses about earnings differentials by sex: (i) taste for discrimination on the part of employer, (ii) information available to males and females and (iii) labour market segmentation. All the three hypotheses mutually support one another. Women invest less (both education and labour market information) compared to men. Why women do not seek as much information as men inspite of its availability? To search an answer to this question seems to be a valuable attempt.

There has been a repeated debate that no attempt has been made by any wage fixing machineries in India to collect empirical data at the individual level on wage structure in various levels of government and private sector for the purpose of comparison and investigation of the extent of difference. More detailed study is needed with the comparable data to answer the wage determination process in the public and private sectors. Similarly, an investigation of differences in non-wage benefits between the sectors and the impact of union are also important for analysing the sector choice decision.