

Education, Experience, and Earnings
A Multilevel Analysis
A Case Study of the Manufacturing Sector in Iran

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Abstract

This thesis examines the relationship between education, experience, and earnings in the context of human capital theory in the manufacturing sector of Iran. Using a sample of 15755 full-time male workers clustered within 35 firms, both single-level and multilevel statistical techniques were employed to evaluate the contribution of education and experience to earnings. The research also examines the advantages of applying a multilevel method of analysis to investigate the above relationship.

This study has shown that, in the manufacturing sector of Iranian industry, the amount of education and experience is significantly and systematically associated with the earnings of employees. This helps to corroborate the notion that human capital acquired through education and experience provides individual economic benefits through improving the earning capacity of individuals. These findings are consistent with many other analyses of earnings based on human capital theory.

The multilevel analysis showed that data used are affected by a hierarchical or clustered structure and the relationship between human capital variables and earnings varies across firms. As a result, as argued by multilevel methodologists and confirmed by our findings, the application of the OLS models in a hierarchical structure leads to incorrect inferences. This study has also shown that the relatively new statistical technique of multilevel modelling provides a powerful tool for examining earnings differentials and some of the effects of labour market structures on earnings. In general the use of a multilevel model provides evidence for the pecuniary externality effects of human capital. By treating individual firms as second level units of analysis, it has been shown that part of the differences in earnings can be attributed to the firms in which individuals are working. In particular clusters of highly educated people seem to have a positive effect on the amount of human capital created through experience. It would be interesting to see whether this finding has wider application. The multilevel technique also strengthens the explanatory power of human capital variables.

Using qualitative methods, this research also examines the question “why does investment in human capital increase earnings?” The main findings tend to support the human capital interpretation of education rather than pure screening.

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Molavi, one of the greatest Persian poets in the thirteenth century, describes the understanding and observation of a person of the reality through describing an elephant in a dark room. For that purpose, he was exhibiting an elephant in a dark room that people were gathered to see the elephant. But as the place was so dark to permit them to see the elephant, they all felt it with their hands, to gain an idea of what it was like. He worded the observations of different people as follows:

One felt its trunk, and declared that the beast resembled a water pipe; another felt its ear, and said it must be a large fan; another its leg, and thought it must be a pillar; another felt its back, and declared the beast must be like a great throne.

According to the part which each felt, the person gave a different description of the animal: one, as it were, called it "Dal" and another "Alif".*

He finally concludes:

If anyone had a light (candle) in his hand, the difference between the description of the animal would disappear.

* Persian alphabet letter.

Chapter 1 Introduction

This chapter begins by describing the general background to the research. A discussion of the aims of the study and the research questions follows. The structure of the thesis is also outlined.

1.1 Background and Points of Interest

Individuals develop their productive capacities in large part through attending courses at school and university or college as their formal education, and on-the-job training and learning by doing as their non-formal education. An individual (above compulsory school age) has a choice of attending, for example, a college or entering the labour market. If s/he attends a school course, s/he may have to pay tuition fees and other direct costs of education, and living expenses, and to forgo earnings. This behaviour of the individual has long been of interest to economists and other social scientists. In fact, they have tried to explain what induces people to undergo and pay for educational activities. A range of explanations and hypotheses has been provided by social scientists. Economists have tried to explain individual behaviour through the

concept of human capital. According to this concept, an individual undergoes and pays for educational activities for the sake of future economic gain, particularly earnings.

Following this interpretation of individual behaviour, the notion of investment in human capital emerged. It stems, in fact, from work in the eighteenth century. For example, in the 1770s Adam Smith in his masterpiece, *The Wealth of Nations*, identified the improvement of workers' skills (e.g., through education) as a source of personal incomes which partly explains earnings differentials. However, the notion has been considered as a separate topic in economics only in the twentieth century. In the 1930s Walsh (1935), for example, tried to investigate whether expenditures incurred by persons for the sake of their professional careers were a capital investment made in a profit-seeking and equalising market, and in response to the same motives that lead to investments in conventional capital. In the early 1960s the "human capital" concept entered the main stream of economic literature when Schultz (1961) in his inaugural lecture to the American Economic Association analysed educational expenditure as a form of investment; and by Becker's book with the title of *Human Capital* (1964; Reprinted in 1993). In this Becker developed a theory of human capital formation and analysed returns to investments in human capital.

The concept of human capital, therefore, is the idea that individuals spend on themselves by means of education, training, on-the-job learning, job search, and the like for the sake of future economic benefits. Individuals may acquire additional education, choose jobs with low pay but with a high training and learning potential, and spend time searching for a job with the highest possible rate/level of pay. All these activities are costly, as they involve direct expenses such as tuition and fees paid for school/college

attendance, the cost of books and supplies, or the cost of enrolling in a (private) school, and indirect cost consisting of the earnings or consumption foregone while the human capital investments are being made. Costs are incurred not for the sake of present enjoyment, but in the expectation of future pecuniary and non-pecuniary benefits. Since benefits derived from these investments accrue mainly in the future, the costly acquisition of productive capacities is viewed as an investment. It follows that the standard tools of economic analysis can be applied to the determinants and consequences of investments in human capital. In other words, in such a situation it is possible to measure the profitability of investment in human capital using the same techniques of benefit-cost analysis and investment appraisal that have been traditionally applied to physical capital. That is, through using cost-benefit techniques, a comparison between the economic profitability of, for example, different levels of education can be made.¹

Since the birth of human capital theory very many attempts have been made to test its basic ideas. In particular, there have been efforts to analyse the association between higher education and higher earnings. The association provides evidence that students undergoing educational activities may be motivated by economic benefits and that education and (on-the-job) training are good investments, which are rewarded in the labour market with higher earnings.

Two approaches have been employed in this field; one is concerned with collecting data about the intention of students to continue their education in order to

¹ Besides direct economic benefits, education may have direct consumption and other non-economic benefits, which are elaborated in chapter 2.

study “whether or not they take a systematic forward-looking view of earnings prospects” (i.e., an *ex ante* approach). This approach is used in the works of Freeman (1976), Williams and Gordon (1981) and Menon (1997). The other is to collect data about employees’ educational qualifications and their earnings (i.e., an *ex post* approach) which is the focus of this study. This has been chosen because through this approach (rather than the *ex ante* one) it is possible to collect data from the real world to investigate the effects of both human capital variables (such as education and experience) and non-human capital factors (e.g., the characteristics of enterprises) on earnings.

Many efforts have been made to establish a relationship between education and training and earnings and, in turn, to evaluate returns to education and training. Some of the most well known are the studies by Mincer (1958, 1974), Psacharopoulos (1973, 1981, 1985), Psacharopoulos and Williams (1973), Psacharopoulos and Layard (1979), Becker (1962, 1993), Schultz (1961, 1962), Carnoy (1995), Griffin and Ganderton (1996), Kingdon (1997), and Cooper and Cohn (1997). Generally speaking, the results of all studies tend to support the existence of an association between higher education and higher earnings. However, the conventional evaluation of returns to education and the contribution of education and training to increasing earnings, derived from the well-known Mincerian earnings function, has been questioned because it ignores factors such as the quality of education (Griliches, 1977; Betts, 1995), ability (Griliches, 1977; Fagerlind, 1987), firm size (Siebert and Addison, 1991, cited in Polachek and Siebert, 1993; Idson, 1995; Velenchik, 1997), team work (Idson, 1995), and geographical aggregation and location (Bisdsall and Behrman, 1984; Griffin and Edwards, 1993; Velenchik, 1997). It is argued that ignoring these factors leads to bias in estimating

returns to education and training. Nevertheless, little attention has been devoted to assessing the efficiency of the conventional OLS estimates, which rely on data dominated by a hierarchical structure. In other words, the empirical analysis of the relationship between education and training (experience) and earnings in the context of human capital has mainly been based on a single-level methodology assuming that the groups in which the individuals are clustered have a constant effect, if any, on earnings of the individuals. In reality, however, this may not be the case. That is, individuals in different groups may receive different levels of wage/salary, holding human capital variables constant. During their working life, they may experience different growth rates of earnings. Such phenomena are in part due to the fact that the group and its members both influence and are influenced by the group membership. To ignore this relationship, as Goldstein (1995:2) makes clear, risks overlooking the importance of group effects, and may render invalid many of the traditional statistical analysis techniques used for studying data relationships. For instance, it may lead to a situation where earnings of individuals in the same group are correlated to each other. Such correlation undermines one or two of basic assumptions on which the single-level method of analysis (OLS) is based. This causes the OLS estimates to be inefficient and, in turn, unreliable for the purpose of testing of hypotheses. For the purpose of policy implications, therefore, it is very important to examine empirically the existence of such statistical problems.

To deal with such issues, a set of firms from the manufacturing sector in Iran was selected. Data from such firms enabled us to examine the effects of clustering on the issue of hypothesis testing. Such a data set provides a practical and actual example of data dominated by a clustered and hierarchical structure in the real world. Besides,

studying human capital analysis of earnings in the manufacturing sector can provide information for the sake of policy implications and also serve an academic purpose. In particular, concerning the latter purpose, it was of interest to assess the explanatory power of human capital theory in the context of the manufacturing sector. No study, to date, has been conducted to analyse earnings differentials in the context of human capital theory in this sector in Iran.

The new technique of multilevel analysis deals with such clustering effects. Through employing this technique one is able to obtain statistically more efficient estimates of regression coefficients. By using the clustering information, the multilevel technique provides correct standard errors and significance tests, and these generally will be more “conservative” than the traditional methods. (Goldstein, 1995:3) By allowing the use of covariates measured at any of the levels of a hierarchy, it enables us to explore the extent to which differences in average earnings between firms may be accounted for by factors such as the characteristics of firm or other factors. It also makes it possible to study the extent to which firms differ for different kinds of employees. For example, it can be examined whether the variation between firms is greater for firms with higher or lower stocks of human capital.

In empirical human capital analysis of earnings it is conventional to employ potential years of experience to account for earnings variation attributed to on-the-job training. That is, it is assumed that graduates start their working lives immediately after graduation. (Mincer 1974:84) We consider such an assumption implausible for the case of countries experiencing a relatively high rate of unemployment. We examine the relaxation of this assumption and its empirical effect on the coefficient of years of

experience, through employing actual versus estimated years of experience. The variation of the contribution of years of schooling at different stages of education and the cross-effect of education and experience are two other important issues which have not been illuminated and investigated properly.

Although there is general agreement on the fact that there exists a strong association between higher education and higher earnings from an individual standpoint, the reason for which (higher) education leads to higher earnings has long been debated between human capital theorists and supporters of the screening hypotheses. The human capital view holds that education provides the cognitive, behavioural and manual capacities that increase productivity on the job and therefore earnings. In contrast, in the screening and signalling theories of Arrow (1973), Spence (1974), and Stiglitz (1975) education is an indicator of pre-existing ability. More able individuals invest in education to signal their higher abilities. Employers, therefore, use educational qualifications to select more able individuals in the absence of any better information, but education itself does not contribute to productivity.

Several attempts have been made to study empirically the debate between human capital theory and its rival hypotheses through employing various research methods such as investigating the relationship between education and productivity in agriculture (e.g., Welch, 1970; Lockheed, 1987) and industry (e.g., Fuller, 1970; Min, 1987, cited in Carnoy 1994); comparing earnings of the self-employed or employees in the private sector, as a non-screened group, with those of the employed as a screened group (e.g., Wolpin, 1977; Riley, 1979; Katz and Ziderman, 1980; Grubb, 1993; Arabsheibani and Rees, 1998); and analysing supervisors' ratings of their subordinates, which were

regarded as a productivity criterion (Medoff and Abraham, 1981). However, little attention has been devoted to illuminating the core of the debate, that is, why employers are willing to pay more to more highly educated workers and whether they consider education as well as training as productivity-enhancing elements. Besides, the above mentioned methods are able only to establish a correlation between human capital variables and earnings. Such a correlation may provide evidence to imply that more educated employees are paid more because they are more productive. It does not indicate whether the greater productivity of the employees is due to additional education or to higher innate ability. Moreover, when data are derived from a relatively homogeneous set of observations in the sense that employees selected from an (non-screened) economic sector, such methods are not appropriate to examine the productivity-augmenting role of education. Some evidence on such issues can be derived from interviews.

Screening hypotheses fail to provide any explanation for individuals' and firms' investment spending on human capital through training and on-the-job learning. In our qualitative analysis, we extend the debate by including these forms of investment. That is, we intend to examine the question whether investments in human capital through education, experience, and training are thought by employers to improve the productivity of their employees.

1.2 Research Questions

In the preceding section, a general background to the research and the points of interest have been described. The main research questions, which are the focus of this

study, are as follows:

1. Do education and experience contribute to increasing earnings in the manufacturing sector in Iran? If so, to what extent?
2. Is a multilevel statistical analysis a more appropriate approach than the conventional OLS for evaluating the effects of education and experience on earnings?
3. Is the contribution of education (as well as experience and training) to higher earnings due to the productivity-augmenting role of education or does education serve only as a filter to identify abler workers?

For the purpose of studying the first two research questions, statistical analyses (i.e., earnings functions) using data from the manufacturing sector were employed which enabled us to evaluate the contributions of, among other factors, education and experience to increasing earnings. In particular, these analyses have contributed to the understanding of patterns of employee earnings differentials and, therefore, helped us to evaluate the explanatory power of human capital theory in the context of the manufacturing sector. Since data have been derived from a labour market, which is dominated by a hierarchical structure (i.e., employees are grouped or clustered within a firm and that the group and its members both influence and are influenced by the group membership), it is argued that applying the conventional OLS methodology cannot provide reliable results for testing of hypotheses.² The research, therefore, attempted to examine the advantages of employing multilevel models in the context of human capital

² More elaboration is given in chapter 3.

investigation of earnings differentials through comparing the results of an OLS approach with those of a multilevel one. To do this it was essential to have data in as much detail as possible. Having detailed data from the manufacturing sector of Iran, we were able to investigate the effects of a hierarchical structure on statistical analysis of earnings in the context of human capital theory.

To collect data for the examination of the third research question, we interviewed the representatives of 10 firms. Qualitative methods of analysis were employed to analyse data; a number of main themes were identified, and data were analysed in detail and reported using indicative quotations to examine the views of employers in connection with investment in human capital and productivity.

1.3 Organisation of the Thesis

This thesis consists of eight chapters. Chapter 1 outlines the aims and objectives of the study. Chapter 2 deals with the theoretical and empirical background to the issues, showing the development from an *ad hoc* explanation of the education and earnings relationship to a systematic one (i.e., human capital theory). It also reviews the developments and criticisms of human capital theory during the last three decades, to highlight the points that need further investigation. In particular, it was found that empirical estimates of the impact of human capital variables on earnings (derived from the human capital analysis of earnings applying Mincerian types of earnings function) have been criticised, though in an *ad hoc* manner, mostly for ignoring some relevant variables. Applying multilevel modelling, we argue that such variables can systematically be classified into different levels making it possible to provide a better

and a more systematic explanation of the determinants of earnings. Moreover, as mentioned above, little attention has been paid to the issue of the efficiency of the traditional OLS estimates,³ which have extensively been used in the literature. In particular, it was found that there has been no study investigating earnings determinants in the manufacturing sector in Iran.

The third chapter discusses the methods of investigating the research questions. Research questions are elaborated, and the concepts, units of analysis, and variables employed are defined and discussed. Methods of collecting and analysing data are examined and justified. In particular, a multilevel statistical experiment was proposed through which the effects of clustering on the estimates of the coefficients of human capital variables could be examined.

Since the manufacturing sector of Iran's economy has been selected as a case study, chapter 4 gives the reader some general information concerning the current political and economic structure of Iran, and describes the manufacturing sector as well as the education system of the country. Information presented in this chapter makes it possible to compare the characteristics of the sample of firms used in this study with those of the manufacturing sector, which were derived from the general population and housing censuses. In particular, it helps us to examine dramatic changes in the number of students at and graduates from higher education institutions, which is helpful for the interpretation of the results of the earnings functions.

³ Few studies examine the issue of heteroscedasticity, which are reviewed in chapter 2.

With regard to the first research question, chapter 5 presents a brief descriptive review of the characteristics of the observations and reports the results of the traditional OLS analysis of earnings. It was found that the conventional human capital variables explain a relatively large part of the earnings variation among the employees, and the results are consistent with human capital theory and most of the empirical studies. It was also found that employees who have had managerial responsibility earn more than their counterparts who have not had any managerial responsibility. In connection with the examination of effects of other determinants of earnings on the coefficients of human capital variables, we attempted to include firm variables, such as size, geographical location, and industry, in earnings functions. All these variables were found to be important determinants of earnings and therefore consistent with other empirical investigations.

Chapter 6 investigates the appropriateness of multilevel techniques in human capital analysis of earnings and presents the results of the multilevel analyses. At first, the question whether data used were dominated by a hierarchical structure was examined. Statistical tests showed that this is the case; therefore to have efficient estimates, application of multilevel analysis is essential. Then, the issue of the reliability of hypothesis testing was investigated and it was found that in a hierarchical structure, the conventional OLS estimators may mislead us in testing of hypotheses. As a result of our analyses, we found that the conventional variables at firm level (i.e., size of firm, geographical location and industry) become insignificant when the cluster effects are incorporated through employing the multilevel technique. This technique also enabled us to study the effects of contextual variables at firm level such as the average stock of human capital in each firm, which shed light on the issue of the external pecuniary

benefits of human capital density. Overall, the results of multilevel analysis highlight the importance of human capital variables and weaken the role of non-human capital variables in the determination of earnings. The last part of the chapter examines the relevancy of estimated instead of actual years of experience in the context of the manufacturing sector. It was found that the inclusion of estimated years of experience would overstate the effect of experience on earnings.

Chapter 7 focuses on the debate between human capital theory and screening hypotheses concerning the productivity-enhancing role of education. For that purpose, qualitative methods of analysis were used. In the first section of the chapter, data concerning the employers' views of the role of education in recruitment and increasing productivity is presented and analysed. Experience and training, as two other important elements of human capital, were examined from the viewpoint of the representatives of selected companies in the next two sections. The results of the analyses in this chapter tend to support the human capital theory proposition asserting that investments in human capital, in general, and education, in particular, improve the productive capacity of individuals. Moreover, employers do consider educational qualifications as a screening device to help them in the initial selection of their prospective employees.

The last chapter presents a summary of the results and proposes methodological and policy implications.

Chapter 2 Theoretical and Empirical Background

2.1 Introduction

This study investigates the relationship between education, experience and earnings in the context of human capital theory. In this chapter, the theoretical and empirical considerations are reviewed. The first part of the chapter looks at the theoretical developments from Adam Smith's explanation of education and wages/earnings differentials in the 1770s to the birth and subsequent developments of human capital theory and its rival hypotheses. The second part critically examines the empirical studies of human capital theory based on (Mincerian) earnings functions accompanied by a review of the literature on the screening and signalling hypotheses. Finally, a summary and some conclusions follow highlighting some of the shortcomings of previous empirical research, which merit further investigation.

2.2 Theoretical Status of Investment in Human Capital

In this section, we review human capital interpretation of spending on human beings. Then, the Shaffer's critique of human capital concept, that is the application of

the concept of capital to man, is illuminated. In 1970s, some alternative hypotheses emerged challenging the notions of human capital theory. Last part of the theoretical section deals with the debate between human capital theory and its rival hypotheses.

2.2.1 Human Capital Theory

Treating human beings within the framework of capital analysis is by no means new. The analogy between human beings and their skills and physical capital have been recognised for a long time.

William Petty, the early actuary and national income accountant, is generally credited with the first serious application of the concept of human capital, when in 1676 he compared the loss of armaments, machinery and other instruments of warfare with the loss of human life (Rosen, 1987: 682). Labour to him was the father of wealth (Kiker, 1966:3). However, it was Adam Smith who set the subject on its main course. In his masterpiece the *Wealth of Nations*, he identified the improvement of worker's skills as a fundamental source of economic progress and increasing economic welfare. He also demonstrated how investments in human capital and labour market skills affect personal incomes and the structure of wages (Rosen, 1987:682). Nevertheless, in 1930s empirical investigation in connection with cost imputation of human capital value was launched. For example, in 1935 Walsh was the first economist who attempted to apply a cost-benefit technique of analysis to education as an investment and particularly interested in whether expenditures incurred by persons for professional careers were a capital investment made in a profit-seeking, equalising market, and in response to the

same motives that lead to investments in conventional capital. In his analysis, Walsh concludes that:

The outcome tends to corroborate the doctrine that useful abilities acquired through professional education are subject to the same influences as other forms of capital. Investment in training these capacities tends to be made as long as the returns promise to cover the cost of that training with an ordinary commercial profit. (Walsh, 1935: 284)

However, the substantial and systematic impetus for rapid progress in this area was launched in the late 1950s and early 1960s. The first impetus stems from economists' interests in understanding the nature and sources of economic growth (the works of, e.g., Schultz, 1961; Denison, 1962; and Becker, 1962, 1964, *reprinted in*: Becker 1993), the earnings differentials (studies by Mincer, 1958; Miller, 1960; and Becker, 1964, *reprinted in*: Becker 1993), and, in turn, incentives for investing in human beings (e.g. Schultz, 1959; and Becker, 1964).

In terms of the application of a theoretical framework for the analysis of earnings differentials, it was Mincer who in his pioneering work in 1958, *Investment in Human Capital and Personal Income Distribution*, tried to explain earnings differentials in the context of human capital theory. Mincer in this study finds that:

The implications for income distributions of individual differences in investment in human capital have been derived in a theoretical model in which the process of investment is subject to free choice. The choice refers to training differing primarily in the length of time it requires. Since the time spent in training constitutes a postponement of earnings to a later age, the assumption of rational choice means an equalization of present values of life-earnings at the time the choice is made. As Adam Smith observed, this equalization implies higher annual pay in occupations that require more training. (Mincer, 1958: 301)

So it indicates that, from the viewpoint of individual behaviour, individuals choose to invest in themselves so as to maximise (the present value of) their life time earnings. In fact, this and subsequent works by Mincer have provided the basis for a vast body of empirical research on the level and distribution of life cycle earnings and the returns to education in the context of human capital theory. (Willis, 1986: 549)

However, it was not until Schultz's inaugural address to the American Economics Association in 1960 that the concept was fully developed and entered into the mainstream of economic literature.¹ Irrespective of the macroeconomic aspect of human capital theory, Schultz emphasised the micro and individual aspect in which he highlights the motives for spending money on education and other kinds of human capital formation such as health, migration, job searching, etc. In that respect he argues:

Although it is obvious that people acquire useful skills and knowledge, it is not obvious that these skills and knowledge are a form of capital ...

Much of what we call consumption constitutes investment in human capital. Direct expenditures on education, health, and internal migration to take advantage of better job opportunities are clear examples. Earnings foregone by mature students attending school and by workers acquiring on-the-job training are equally clear examples. ... In these and similar ways the quality of human effort can be greatly improved and its productivity enhanced. I shall contend that such investment in human capital accounts for most of the impressive rise in the real earnings per worker. (Schultz, 1961: 97)

The fundamental framework of analysis for virtually all subsequent work in this area was provided by Becker who not only organised the emerging empirical observations but also provided a systematic method for seeking new results and

¹ More discussion is provided, for example, by: Rosen (1987) and Mace (1992).

implications of the theory.² In accordance with Schultz's analysis, Becker organised his theoretical development around the concept of the rate of return on investment, as calculated by comparing the earnings streams in discounted present value on alternative courses of actions. In Becker's view, rational agents pursue investments in their education and training up to the point where the marginal rate of return equals the opportunity cost of funds. After criticising the reluctance of economists to interpret improvements in the effectiveness and amount of human resources in the same way as expanding physical capital, he highlights the explanatory power of investment approach to human resources for a wide range of phenomena to justify the application of investment theory in the context of human beings. In that respect he states that:

... an investment approach to human resources is a powerful and simple tool capable of explaining a wide range of phenomena, including much that has been either ignored or given ad hoc interpretations. (Becker, 1964 *reprinted in*: 1993: 85-86)

An example in that connection is that a relatively large fraction of younger persons are in school or on-the-job training, change jobs and locations, and add to their knowledge of economic, political, and social opportunities. Such behaviour may be explained in the way that the young are relatively more interested in learning, able to absorb new ideas, less tied down by family responsibilities, more easily supported by parents, or more flexible about changing their routine and place of living. However, in Becker's view, the main explanation is that younger people have a greater incentive to invest in themselves because they can collect the return over more years. In Becker's words:

² More details concerning the initial developments of human capital theory are given in Bowman (1966).

One need not rely only on life-cycle effects on capabilities, responsibilities, or attitude as soon as one recognises that schooling, training, mobility, and the like are ways to invest in human capital and that younger people have a greater incentive to invest because they can collect the return over more years. (*Ibid.*)

Although formal schooling is one way in which human capital can be accumulated, it is not the only route. Many individuals and workers' skills are acquired through (on-the-job) training, ranging from formal training sessions to the much more informal on-the-job training. These issues have been considered initially by both Mincer (1962 and 1974) and Becker (1962 and 1964, reprinted in 1993), but it was Becker who developed a set of comprehensive theoretical underpinnings in the context of human capital theory. He distinguished general from specific training. General training in Becker's view refers to activities that generate extremely transferable skills equally usable or saleable in any firm or industry. For that reason general training increases the productivity of a worker at many jobs.

General training is useful in many firms besides those providing it ... Most on-the-job training presumably increases the future marginal productivity of workers in the firms providing it; general training, however, also increases their marginal productivity in many other firms as well. (Becker, 1964 reprinted in: 1993: 34)

Other kinds of training increase productivity in the firms providing the training more than in other firms. These kinds of training Becker calls *specific* training. Completely specific training can be defined as training that has no effect on the productivity of trainees that would be useful in other firms.

A key question that emerges here is who should bear the cost of training and who recoups the gain from the investments.

If all training were completely specific, the wage that an employee could get elsewhere, as Becker claims, would be independent of the amount of training he had received. In that case, firms provided that they could appropriate all the return would have to pay training costs, for no rational employee would pay for training that did not benefit him. (*Ibid.*: 41)

However, firms will be unwilling to bear any of general training costs if labour markets are competitive. The reason is that since general training is transferable, any worker who receives general training paid for by the firm could quit upon completion of training, and the firm would be unable to recoup any of its general training investments in the worker. Therefore, the worker should bear the cost of training. In Becker's words:

... firms would provide general training only if they did not have to pay any of the costs. Persons receiving general training would be willing to pay these costs since training raises their future wages. Hence it is the trainees, not the firms, who would bear the cost of general training and profit from the return. (*Ibid.*: 34)

In reality, however, completely general and specific training are polar extremes, and in many cases, investments in human resources represent a mix of these two types of training. That is, much on-the-job training, as Becker explains, is neither completely specific nor completely general but increases productivity more in the firms providing it and falls within the definition of specific training. The rest increases productivity by at least as much as in other firms and falls within a definition of general training.

However, once we move away from the perfect competition market, freely functioning markets of theory to real world situations, as Ziderman (1978: 23) remarks, the careful distinction drawn between general and specific training (i.e. Becker's classification) loses much of its significance. Training provided under monopsony

conditions, even if general in essence, becomes firm-specific in reality. Conversely, training that may have been *de facto* specific will be rendered general by competitive entry. It is the potential mobility of trainees, therefore, not the generality of skills, as such, that is critical to the training investment decision of a firm. Firms are unlikely to invest in trainees with a high probability of moving, which is seen to be related partially to the generality of training provided. Thus, firms would finance investment in general training if there were a low mobility potential and if the general training being converted to a specific investment by labour market imperfections, geographical location, the institutional setting, internal labour market, etc. (The same critique of Becker's training theory was presented by Stevens, 1996.)

Regardless of the issue of financing *training* investment, in the context of human capital theory it is also assumed that additional human capital can be accumulated by incremental job experience. Such accumulation of human capital varies across jobs, firms, time spans, etc. As far as I am aware, little effort beyond the theoretical developments has been devoted to clarify and elaborate these kinds of human capital formation.

The idea of investment in human capital through a variety of ways and the expectation of future returns have been addressed more explicitly in 1970's literature onwards. Blaug (1976a) in his paper (*The Empirical Status of Human Capital Theory: A Slightly Jaundiced Survey*), for example, highlights future returns (in both pecuniary and non-pecuniary terms) as an explanation of why people invest in themselves. He explains that the hard core of the human capital research programme is the idea that people spend on themselves in diverse ways (e.g. through education, in-service training,

health, job search, information retrieval, and migration) not for the sake of present enjoyments, but for the sake of future pecuniary and non pecuniary returns. All these phenomena, therefore, may be viewed as investment rather than consumption. What knits these phenomena together, in Blaug's view, is not the question of who undertakes what, but rather the fact that the decision-maker, whoever he is, looks forward to the future for the justification of his present actions. (Blaug, 1976a: 5)

Woodhall also remarks that "the concept of human capital refers to the fact that human beings invest in themselves, by means of education, training, or other activities, which raises their future income by increasing their lifetime earnings." (Woodhall, 1995: 24)

2.2.2 Shaffer's Critique of Human Capital Concept

The above consideration provides a theoretical framework to shed light on analysing individuals' investment in self-improvement. However, this notion (i.e., the hard core, in Blaug's terms) of human capital and the attempt to apply the concept of capital to man were not without its critics. After the birth of human capital theory, Shaffer (1961) attacked the notion. He argued that investment in man is essentially different from investment in non-human capital. Because a part of any one direct expenditure for the improvement of man, in Shaffer's view, is undertaken for reasons other than the expectation of a monetary return, it has no traceable effects on future output and satisfies wants directly. To the extent to which, as he claims, any part of such an expenditure is investment it is inseparable from other parts which are not being classified as investment.

Where it is possible to separate consumption expenditure from investment in man, it would still remain, in Shaffer's view, a virtual impossibility to allocate a *specific* return to a *specific* investment in man.

In the case of overcoming the above difficulties and impossibilities Shaffer believed that it would in most instances still be ill-advised, from the viewpoint of social and economic welfare, to utilise the information thus obtained as the exclusive or even the primary basis for policy formation. (Shaffer, 1961: 46)

These kinds of criticism can be classified, at least, into two categories; theoretical and methodological aspects. In terms of theory, Shaffer's argument weakened and even denied any economic motivations of students and parents to invest in education. In his view, as Schultz (1961 *revised in*: 1971: 52) states, the students and parents are motivated as current consumers of education but only weakly or not motivated at all as investors in education. Undoubtedly, it is true that some education is wholly for current consumption, and obviously in that case, as Schultz explains, there would be no investment opportunity, hence no bases for investment motivation. But, prospects of larger future earnings play a strong motivating role in the case of students who attend medical schools, schools for dentists, engineers, accountants, etc. In that connection, Williams provides a clarification that "there are always some individuals who will go to the university under almost any circumstances. There are others who are equally certain not to do so. Between these extremes lies a spectrum of individuals more or less likely to go, depending on circumstances. The economic model claims that over parts of this spectrum, expectations of economic return are a factor influencing the decisions of some individuals." (Williams, 1984: 82)

Shaffer's criticism of human capital theory, it would seem, has not been pursued much further by economists. Convincing results of some *ex ante* studies of human capital theory (e.g., works of Freeman, 1971, 1976; Williams and Gordon, 1981; and Menon, 1997) and investigations of educational choice of students in which (future) earnings and the possibility of getting a job as the influential factors in students' choices were taken into account (e.g., study by Borghans *et al*, 1996: 71) indicate that there are unlikely to be such criticisms in the future either.

The rest of Shaffer's points are methodological. For example, the difficulty of separating consumption from investment element of spending on education is directly related to providing more appropriate and accurate data (i.e., that of investment rather than both investment and consumption) to test the key notion of human capital theory. Trying to achieve the highest degree of accuracy in that respect indeed works in favour of rather than against human capital theory, because in such circumstances the rates of return to education, as Schultz (1959) puts it, would be higher than those of conventional way of computing.

The matter of attribution of a specific return to a specific investment in man is again related to the method of data analysis. Of course, by applying regression analysis it is much easier to do so through controlling for other influential factors.

In sum, it can be said that the notion of the human capital paradigm, that is the explanation of individual investment behaviour, has a strong theoretical and empirical base. However, in the 1970s screening hypotheses emerged that challenged the basic assumption of human capital theory that it is investment in human capital that improves the productive, and in turn future-earnings, capacity of individuals. In the following section the debate between human capital theory and its rivals is elaborated.

2.2.3 Screening Hypotheses

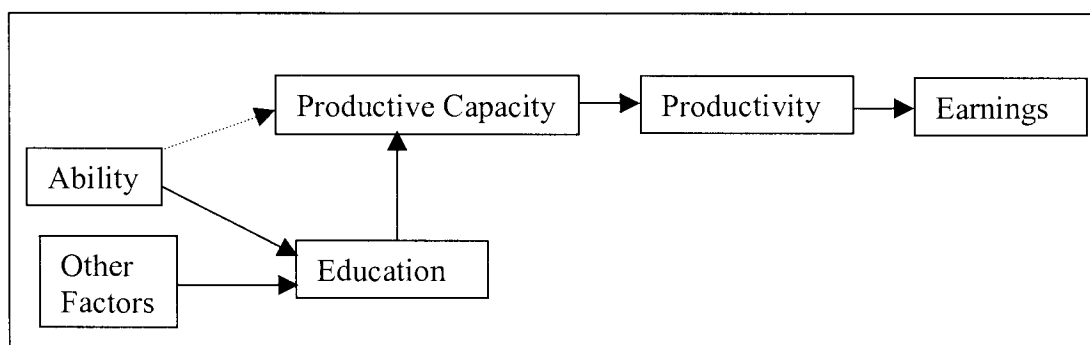
In section 2.2.1, we reviewed the relevant issues concerning theoretical underpinnings of investment in human capital. We found that human capital theory could provide a theoretical explanation to justify individual behaviour in investing in themselves. As Cohn and Geske (1990: 34) point out, the basic premise of the human capital approach is that variations in labour income are due, in part, to differences in labour quality in terms of the amount of human capital acquired by the workers. This premise, however, is based on a strong assumption that investments in human capital improve the productivity of workers, and hence increase earnings through imparting useful knowledge and skills. This assumption has been attacked by critics³ who have argued that the higher earnings of more educated workers reflects their superior ability, higher social background, stronger motivation, etc. rather than specific knowledge and skills acquired during the educational process. These critics, therefore, are sceptical about the productivity-augmenting role of education. In their view education serves as a screening device to select the abler workers.⁴ In what follows we elaborate the debate between human capital theory and its rival hypotheses.

³ Among others are Arrow (1973, 1974), Filtering Theory; Spence (1973), Signalling Theory; and Stiglitz (1975), Screening Hypothesis.

⁴ It is worth noting that the signalling and screening hypotheses challenging the productivity-augmenting role of education are not exactly identical. For example, in the view of the signalling hypothesis education does not contribute to society's net output, however in the view of screening education does have social value by signalling the more productive workers and thus bringing about an improved allocation of labour. Discussion presented in this section is confined to the question of whether education is a productivity-enhancing element or a screening device. A more detailed discussion concerning differences between the hypotheses is provided, e.g., by Johnes (1993a: 18-22).

Human capital theorists have highlighted the matter of productivity-augmenting effects of investments in human capital. Becker, for example, states that education and training are the most important investments in human capital. Many workers increase their productivity by learning new skills and perfecting old ones while on the job. (Becker, 1964, reprinted in: 1993:31) He also makes clear that ‘human capital analysis assumes that schooling raises earnings and productivity mainly by providing knowledge, skills, and a way of analyzing problems.’ (Becker, 1993: 19) Mincer also in that connection remarks that “If productivity-augmenting investments in human capital continue after the completion of schooling, the time distribution of these investments over the working life creates age variation in earnings.” (Mincer, 1974: 64) And finally, Schultz (1961, reproduced in: 1993b: 97) attributes direct expenditures on education, health, and internal migration to take advantage of better job opportunities, and earnings foregone by mature students attending school and by workers acquiring on-the-job training as clear examples of investments in human capital. He argues that in these and similar ways the quality of human effort can be greatly improved and its productivity enhanced.

Figure 2.1: The relationship between Education, Productivity and Earnings under Human Capital Theory



These kinds of consideration have provided the basic premise and assumption of the human capital theory, which ascertains the productivity-augmenting role of investments in human capital, and particularly in education. That is, it is assumed that investment in human capital, in general, and education, in particular, as Fig. 2.1 shows, directly improve the productive capacity, and in turn earnings, of individuals. (More discussion is given in Mace, 1987.) However, this premise has been challenged by some alternative theories emerged in 1970s such as signalling theory (Spence, 1973), filtering theory (Arrow, 1974), and the screening hypothesis (Stiglitz, 1975). According to these theories, education acts as a signal for pre-existing abilities and as a means for the already better off to get the best jobs, and productivity, therefore, is not altered by schooling. (Groot and Hartog, 1994: 5350) Two sides are involved in the signalling views of education; individual side and employer one.

For the first side, the screening hypotheses provide alternative explanation that justifies the individual investment behaviour in a rather different way. Spence's signalling view, for example, states that an employer cannot directly observe the productive capabilities of an individual at the time he hires him. Nor will this information necessarily become available to the employer immediately after hiring. What the employer observes, as Spence argues, is a plethora of personal data in the form of observable characteristics and attributes (i.e., signals) of the individual, and it is these that must ultimately determine the employer's assessment of the productive capabilities of an applicant. For each set of signals that the employer confronts, he will have an expected marginal product for an individual who has these observable attributes. This determines the offered wage to applicants with those characteristics. Potential employees therefore confront an offered wage schedule whose arguments are

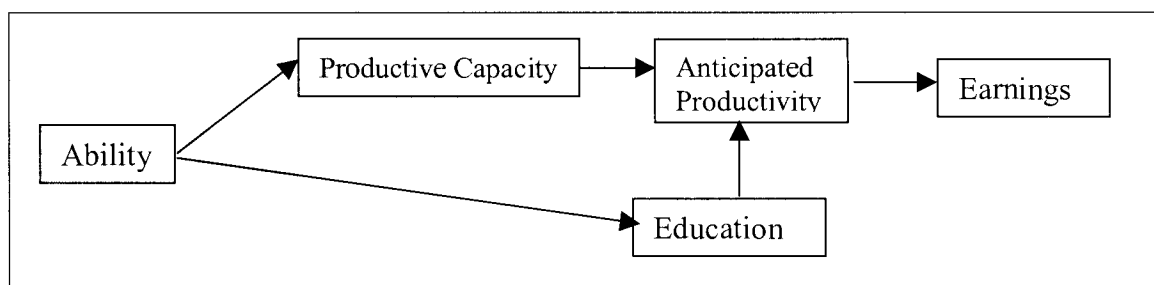
signals. Signals are alterable and therefore potentially subject to manipulation by the job applicant. Of course, there may be costs of making these adjustments. Education, for example, is costly (signalling cost). The individual will invest in education if there is sufficient return as defined by the offered wage schedule. It is postulated in this view that individuals select signals so as to maximise the difference between offered wages and signalling costs. (Spence, 1973)

From the employer side, the “signalling” theory, as mentioned, views education as a signal that yields useful information to identify individuals with higher expected productivity. That is, the employer that cannot observe the productive capabilities of a potential employee at the time of hiring uses some observable characteristics such as education to select more able and more productive applicants through offering appropriate wages to the applicants with those characteristics. (Fig. 2.2 depicts such an interpretation.) This process of selection seems to be very cheap for the employer (Wiles, 1974) because the employer does not pay the costs of education. However, it should be mentioned that the signalling and screening hypotheses fail to explain the behaviour of the self-employed workers and the employers that spend on their employees to develop the employees’ productive capacities after hiring the applicants. (More explanation concerning these alternatives theories is given in: Lazear, 1977; Cohn and Geske, 1990: 58; and Groot and Hartog, 1994: 5350.)

Arrow (1974: 51-52) also attempted to formalise views expressed by some sociologists that diploma serves primarily as a measure of performance ability rather than as evidence of acquired skills. In his well-known paper “*Higher Education as a Filter*” he explicitly postulates that higher education contributes in no way to superior

economic performance; it increases neither cognition nor socialisation. Instead, higher education serves as a screening device, in that it sorts out individuals of differing abilities, thereby conveying information to the purchaser of workers' services who has a poor idea of the workers' productivity. It is assumed instead that the buyer has very good *statistical* information concerning the statistical distribution of productivities, but nothing more, from general information or previous experience. That is, there are, Arrow (1974:52) assumes, certain pieces of information about the worker, specifically whether or not he has a college diploma, which the employer can acquire costlessly. The worker would undergo education to signal his ability, which is of interest to employers. Therefore, the role of education is only to identify the abilities of individuals for potential employers.

Figure 2.2: The Relationship between Education, Productivity, and Earnings under the Screening Hypotheses



Note: It is assumed that employers do not observe the characteristics of employees presented in the shaded area.

For the purpose of illumination, we can classify the relationship between investment in human capital and earnings in two dimensions; First, the existence of a positive relationship between education and earnings, and second the way in which education influences earnings. Both kinds of explanation highlight the fact that increasing earnings is an outcome of educational investment. From the viewpoint of an individual, it makes little, if any, difference whether the human capital or the signalling

hypothesis is valid; in either case the same private return to education can be expected. But from the viewpoint of society as a whole and of employers the situation is different. That is, for a society if the signalling view is valid, then the social return to schooling is overstated. In such a case, instead of subsidising education, it would be better for society to invest its scarce funds in more productive activities by finding and utilising less costly ways to screen high-quality/able workers.⁵ From the employers' view, however, the situation is more complicated and the issues need to be elaborated further.

The way in which education affects earnings is the key debate between human capital theorists and screening theorists. This dimension is concerned with demand for (the services of) human capital and it is employers who provide demand for (the services of) human capital. In that respect, therefore, some relevant questions emerge: How and why do investments in human capital explain earnings differentials? Why do employers offer higher pay to more highly educated workers? Is it because more educated workers are more productive or because education merely serves as a screening device that identifies the more able, highly motivated young people?

These kinds of questions from the viewpoint of an employer can be elaborated in two dimensions; the employer's incentive for paying more to the more educated, and spending for training of their employees. Assuming perfect competition for both labour and product markets, Becker in his theoretical developments tries to make a connection between wage and marginal product of a profit-maximising firm. He argues:

⁵ Since investment in human capital from the viewpoint of society is beyond the scope of this study we confine our analysis to the situation of individuals and employers.

If there were no on-the-job training, wage rate would be given to the firm and would be independent of its actions. A profit-maximizing firm would be in equilibrium when marginal products equalled wages, that is, when marginal receipts equalled marginal expenditure. (Becker, 1964, *reprinted in*: 1993:31)

It should be inferred, therefore, that the willingness of the employer to pay more to more educated workers is directly related to the fact that more educated workers should also be more productive, so there would be a perfect relation between wages and marginal productivity. In these circumstances, as Becker remarks, firms would not worry too much about the relation between labour conditions in the present and future, partly because workers would only be hired for one period and partly because wages and marginal products in future periods would be independent of a firm's current behaviour. As Becker explains, it can be assumed that workers have unique marginal products (for given amounts of other inputs) and wages in each period, which are, respectively, maximum productivity in all possible uses and the market wage rate.

It is worthwhile noting that the above-mentioned relationship between earnings and productivity is consistent with both human capital theory and its rival hypotheses. That is, in either consideration, whether it is education or innate ability that contributes to improving productivity, employers would pay more to more educated workers in that the more educated are abler and more productive. Therefore, there is no a clear cut difference between human capital theory and screening hypotheses, at least, for the purpose of hypothesis testing.⁶ However, the screening hypotheses fail to explain, for example, post-school investments and employer investment in human capital after

⁶ In the next chapter, however, we will suggest a qualitative method of analysis to shed some light on the relationship between education/earnings and productivity.

recruiting their employees. That is, if education, in a general sense, did not contribute to productivity, it would not be justifiable for an employer to finance and provide training for improving the skills of workers and contribute to the payment of educational tuition fees of his employees studying in an educational institution.

Training, as mentioned above, is one way that employers invest in their human resources. In his training theory, Becker developed, what I would call, an explanation of “firm investment behaviour” which he switches human capital theory to the issue of profit-maximising equilibrium of a firm through “taking into account on-the-job training”. In Becker’s view the inclusion of on-the-job training in the investment-decision process of a firm alters the conditions of the equilibrium, which depend only on current period and creates a connection between present and future receipts and expenditures. He, then, remarks:

Training might lower current receipts and raise current expenditure, yet firms could profitably provide this training if future receipts were sufficiently raised or future expenditures sufficiently lowered. Expenditures during each period need not equal wages, receipts need not equal the maximum possible marginal productivity, and expenditures and receipts during all periods would be interrelated. (Becker, 1993: 32)

In fact the firm will invest in human capital only if the discounted benefits accruing to the firm from the human capital investment are sufficiently large to cover the costs of the investment. Only under the productivity-adding role of such investment receipts during all periods would be raised.

2.2.4 Other Benefits of Education

So far, our consideration has mainly focused on the effects of education and training on earnings. There are some other benefits attributed to education that are retained by both the individual being educated and by society. In this section we elaborate such benefits in more details.

Besides the effect of education on earnings various benefits retained by the individual have been identified such as the consumption value of education, the ability to achieve one's desired family size, increasing productivity in the home, influencing the health of family particularly due to the mother's education, higher social status, increasing the individual's choices regarding consumption activities and purchases as well as investment activities (option value), etc. However, it is hard to measure and, in turn, to incorporate such kinds of benefits in calculating private rates of return to education. They are rarely included in empirical estimates of the rates. It is conventional that to calculate the private rates economists have limited themselves to the earnings (i.e., earnings after tax) benefits of education (Carnoy, 1995b: 365) and to the direct costs of education incurred by the individual and earnings forgone.

Social benefits include both the private benefits and other benefits, which the individual being educated cannot capture and other members of society absorb such benefits. The latter can be classified into two categories. First category is tax payments associated with the education benefit (i.e., lifetime earnings stream) which accompanied with public costs of education are conventionally incorporated into the private rates of return to evaluate the social rates of return to education. The other consists of some external benefits that can be captured by members of society other than the persons

schooled and their immediate family (Wolfe, 1995: 159) such as preserving and encouraging democratic freedoms, reduction of criminal activity, increases in social cohesion and technological change, changes in income distribution, encouraging economic growth and expanding economic activities (e.g., producing books, training teachers, etc.). (There are more details in, among others: Weisbrod, 1964; Blaug, 1976b: 105-114; Cohn and Geske 1990: 37-40; Carnoy, 1995b: 364-69; Wolfe, 1995: 159-163, Bennell, 1996; and McMahon, 1997.)

2.3 Empirical Status of Human Capital Theory

2.3.1 Education, Experience, and Earnings: Earnings Functions

The individual investment behaviour in the context of human capital theory has been investigated by many researchers through applying regression techniques. It was Mincer (1958) who initially developed a basic regression analysis framework for the explanation of personal income distribution in the context of human capital theory. He tried to generalise Smith's simple idea about how the costs of training for a profession affect its average earnings. (Rosen, 1992:159) High earnings are required to compensate for the costs of entry, as an equalising difference. He connected the human capital theory to survey data on earnings and earnings inequality. Mincer developed a semi-log regression, which has two key explanatory variables; schooling and experience years, as proxies for human capital investment, and natural logarithm of earnings as the dependent variable. In his earliest work, he concludes:

The empirical evidence is clearly consistent with all the implications of the model about the effects of education, occupation, and age on patterns of personal income distribution. (Mincer, 1958: 302)

In subsequent works, Mincer fully developed his earnings functions. In his 1974 book, *Schooling, Experience, and Earnings*, using data derived from the US decennial Census and Becker's (1962) analytical framework, he introduces life-cycle variations in earnings into the regression equation that enabled him to change the emphasis from age to labour market experience in so-called "age-earnings profile" generally increasing but concave shape of the path of earnings with age. He interpreted on-the-job training broadly to include learning by experience as well as explicit participation in training programmes. Mincer estimated experience as age minus schooling years minus six (the age at which schooling begins in the USA). He included a squared experience element in his equation for the matter of concave-shape of earnings profile and theory implications that the return to investment through on-the-job training falls over working life, as the period over which they can be used becomes shorter and the opportunity costs of investment that increase over working life as a person's wage increases. (Mincer, 1974:84,129; 1979:10) That is, Mincer introduced his basic earnings function as follows:⁷

$$y_i = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X_i^2 + e_i \quad (2.1)$$

where y , S , X , and e are log earnings, years of schooling, years of experience and the error term, respectively.

⁷ Mathematical proof is given in, e.g., Mincer (1974:84-91).

Overall, the earnings function, that is equation (2.1), became a very popular function in the human capital research paradigm.⁸ Most studies have adopted a Mincerian specification in which, as mentioned above, the core regressors are years of schooling, years of experience, and years of experience squared. Some have tried to reaffirm partly the appropriateness of the function and others have attempted to criticise it due to ignoring some other influential factors such as ability, school quality, externalities of investments in human capital, social background, etc.

Among the first group are the works of Psacharopoulos (1985), Dougherty and Jimenez (1991), Psacharopoulos *et al.* (1994), and the like that use the basic Mincerian earnings function and/or confirm, at least some of, its underlying assumptions.

Dougherty and Jimenez's study⁹, for example, tries to test and evaluate the assumptions of Mincerian earnings function that, in Dougherty and Jimenez's (1992: 82) view, are as follows:

- (i) The appropriate definition of the dependent variable is the logarithm of earnings, as opposed to [absolute] earnings as such or any other functional form.
- (ii) There is no interaction between the contributions of the schooling and work experience variables to earnings.
- (iii) A simple function can be used to model lifetime earnings, making no distinction between early and mature labour market experience.

⁸ As Becker remarks in his Nobel Lecture, the earnings equation is probably the most common empirical regression in microeconomics. (Becker, 1992: 393)

⁹ It is worthwhile noting that Dougherty and Jimenez also criticise some other aspects of Mincerian earnings function that we will elaborate later.

Using data, which is a random sample of urban males in Brazil from the 1980 census, they conclude that the semilogarithmic earnings function is superior to its linear counterpart. “This semilogarithmic version [versus linear version] is support by Box-Cox transformation, by relative homoscedasticity in both the schooling and work experience dimensions, and by the relatively normal distribution of residuals.” (*Ibid.*: 96)

A study using Mincerian earnings function, conducted by Psacharopoulos *et al* (1994), uses data on a sample of 1825 workers from the 1990 Household Survey in Paraguay to analyse the relationship between investment in human capital and earnings, and to calculate rates of return to investment in education at different levels. It was found that the sign of the coefficients of the first specification conform with human capital theory and the results of the study are consistent with what has been found in other countries with similar socio-economic characteristics. (*Ibid.*: 321, 325)

On the other hand, some other researchers have tried to criticise the Mincerian earnings function mainly because (i) it ignores some relevant factors influencing earnings such as ability, school quality, geographical location, industry and economic sectors, etc. and (ii) it faces the problems of heteroscedasticity and misspecification. In what follows we review some important empirical literature briefly.

In his well-known paper, Griliches (1977) highlights the various econometric issues that arise in estimating a relation between the logarithm of earnings, schooling and other variables and focuses on the matter of ability as an omitted variable and the various solutions to it. In this regard, he addresses some key questions such as “Why

should the equation [Mincerian earnings function] have this particular functional form?

What other variables should be included in the equation? ...” (Griliches, 1977: 1)

In addressing the various solutions for the problem of omitted ability he emphasises two theoretical points as follows:

- (i) In optimizing models there is no good a priori reason to expect the “ability bias” (or the direct coefficient of a measure of ability in the earnings function) to be positive. Thus, it shouldn’t be too surprising if it turns out to be small or negative.
- (ii) An asymmetrical attempt to protect oneself against possible biases by putting more variables into the equation or by looking only within finer and finer data cuts, can make matters worse, by exacerbating other biases already present in the data. (Griliches, 1977:18)

Using data from National Longitudinal Survey of Young Men of USA, he tries to support the theoretical points and concludes:

Treating the problem asymmetrically and including small direct measures of “ability” in the earnings function indicates a relatively small direct contribution of “ability” to the explanation of the observed dispersion in expected and actual earnings ... But, when schooling is treated symmetrically with ability measures, allowing it, too, to be subject to errors of measurement or to be correlated to the disturbance in earnings function, the conclusions are reversed ... (Ibid.: 18)

It can be inferred that the result of analysis and examining the effects of an omitted variable (e.g., ability) on earnings to correct bias in the schooling coefficient partly depends on the assumption and/or the aim of the researcher. If s/he assumed that schooling is not related to the disturbance term, through employing a simple reduced form of earnings equation, omitting ability would lead to overestimating the returns to education. Including direct measures of ability (e.g., IQ)¹⁰ in the equation would solve

¹⁰ A range of ability measures used in the literature have been summarised by Cohn and Geske (1990: 50).

the problem of overestimating. On the other hand, if s/he tried to evaluate the returns to education in a situation where education is the result, in part, of optimising investment behaviour by individuals and/or their families, and the structure of ability/demand and opportunity/supply¹¹ is taken into account in the endogenous equations, he might underestimate the returns to education by using the simple least squares. Because in such circumstances, schooling and error term are correlated due to interaction between ability and the schooling.

Besides the above criticisms highlighted by Griliches, the empirical analysis of “ability, education and earnings” may face other serious questions. That is, it is innate ability whose effect must be taken into account and, therefore, it can be questioned whether ‘ability’ measures, such as IQ or other mental tests *do* reflect an individual’s innate ability. In fact ability is an unobserved latent variable that not only is difficult to measure¹² but also, as Griliches (1977: 7) points out, both drives people to get relatively more schooling and earn more income, given the same years of schooling, and perhaps also enables and motivates people to score better on various tests.

Moreover, there is a problem with the age at which measures were taken in the empirical studies. That is, these measures of ability, as Mincer (1976) states, grow over time with age and with the early growth of an individual’s human capital. The results of correction for bias in the schooling coefficient would depend on the time at which ability was measured. For example, Griliches and Mason (1972) estimated that the

¹¹ More detailed discussion is provided, e.g., by Becker (1967; *Reprinted in*: 1993:108-158), Mincer (1974: 138), and Atkinson (1982:86-97).

¹² As Mace (1987: 27) states, it seems nobody has devised an adequate measure of innate ability.

coefficient of schooling is reduced by 7-10 percent, if the correction allows for ability measures prior to schooling. If post-school 'ability' measures are used, the downward bias in the schooling coefficient is exaggerated by almost 100 percent. (Cited in Mincer, 1976: 170)

Psacharopoulos and Layard (1979) attempt to apply and to criticise the Mincerian earnings function in another way. They claim that Mincer's regression approach in which log earnings are regressed on schooling, work experience and work experience squared, only yields valid estimations of the direct effects of schooling on earnings if there is no relationship between schooling and the amount of post-school investment and its profitability. A necessary (though not sufficient) condition for this to be true, according to them, is that the profiles of log-earnings, as experience varies, are vertically parallel for all schooling groups. Then they remark:

Casual inspection is not sufficient to verify whether this is so. So the obvious approach is to specify a model in which the pattern of post-school investment and its profitability are allowed to depend on schooling. Such a model also allows one to estimate the rate of return to on-the-job training. (*Ibid.*: 167)

Using data from the UK General Household Survey for 1972 and estimating the Mincerian earnings function, they found a strong relation between schooling and post-school training. The rate of return to training, according to their estimation, grows with schooling and is much higher than the rate of return to schooling (*Ibid.*: 167). However, their empirical findings show a negative rate of return to training for earlier stages of schooling. For example, based on their estimates the rate is -31 percent for a person with no educational qualification, and -7 percent for an individual with 5 years of schooling. (*Ibid.*: 175) The figures seem to be inconsistent with human capital theory.



Geographical aggregation as a source of bias in returns to schooling is another matter that Birdsall and Behrman (1984) highlight in their study.¹³ They argue that estimates of the rate of return to schooling from cross-national samples are likely to be upwardly biased. Geographical aggregation, in their view, can cause such bias for a number of reasons:

Omitted regional prices, systematic under-reporting of earnings and inclusion of unearned income, simultaneity bias due to the role of income in the determination of schooling, migration costs, geographical labour market disequilibrium, and systematic underrepresentation of the private cost of schooling (*Ibid.*: 68).

Using data of adult males in Brazil and controlling for the geographical origins in which individuals went to school and the geographical destinations in which they now earn income, they have tried to explore the above possibilities of bias in the estimates of the returns. They conclude:

Our estimates have patterns of intercept and rate of return shifts that are generally consistent with all of these possible sources of geographical aggregation bias, except for the last one. ... What we do show is that the combination of these biases is positive and substantial. (*Ibid.*: 68)

Based on these findings, they ascertain the probability of overstating the true effect of schooling on earnings and on productivity, reported in some other studies such as Psacharopoulos (1981) and World Bank (1980). To avoid such problems, they believe that better procedures and data must be developed to control for geographical aggregation bias, and standard estimation must be reinterpreted in light of the possibility

¹³ There is also ample empirical evidence that shows the rates of return vary across different geographical areas. Among others are the works of Hanushek (1973), Chiswick (1974), Rauch (1993), and Preston (1997).

of important geographical aggregation bias as well as of the more commonly acknowledged biases. (*Ibid.*: 69)

The size of firm and team size are other elements that influence earnings and, therefore, contribute to earnings differentials. It is generally believed that large firms pay more for equivalent workers than do small firms. Using British data, Siebert and Addison (1991) found that plants employing 1000 or more pay 8 percent more than small plants (employing 100 or less), holding constant the human capital variables plus occupation and industry.¹⁴ (Siebert and Addison, 1991, cited in Polachek and Siebert 1993: 261)

Idson in his recent study attempts to examine evidence on the relationship between an employee's earnings and the size of his team of co-workers. Using data from the 1973 Quality of Employment Survey which contains information on 1496 individuals who are 16 years of age and older, he concludes that both team size and a team production environment exercise significantly positive effects on wages. He also finds that these effects are independent of establishment-size effects on wage, and the results, as he argues, indicate that while some portion of the employer-size effect in wages may be due to team effects, the employer-size effect remains significant even in the presence of team controls. (Idson, 1995: 203)

Idson's findings tend to support the density of human capital that recently has been highlighted by Schultz (1993). Schultz tries to elaborate both internal and external

¹⁴ It is well established, through using the OLS techniques, that employees are paid more in large firms. In chapter 6, attempts are made to find out whether earnings differentials attributed to firm size are caused by the largeness of firms or, for example, by human capital density.

effects of human capital. Schultz believes that there are favourable external effects from having a strong human capital environment. A key to these external effects, as he claims, is human capital density: Specialised doctors in large cities not in small towns, specialised plant breeders in large research centres, etc. (Schultz, 1993a: 14) This may be extended to working in enterprises that already have a high human capital density. This is one of the key themes explained in chapter 6 of this thesis.

Investment in children made by families in the home is another factor that Griffin and Ganderton introduce as a source of bias in earnings equations. They try to study, therefore, differences in the rates of return to education across racial and ethnic groups by taking into account the effect of families investments in children through employing family background as a proxy and also school quality. Using data from the National Longitudinal Survey of Youth of the US, and after controlling for investments in children by parents and by schools (quality), they observed that each major racial group (blacks, whites and Hispanics) has a statistically similar rate of return to schooling and that family and schooling variables create more convergence than does the standard ability measure alone. They also find that the standard Mincer-type approach to estimating earnings functions overestimates the rate of return to education by about one-third. The overestimation, according to them, is due to not controlling for ability and background variables. Furthermore, they show that school quality does “matter” - students attending better schools obtain greater skills, which are then rewarded in the labour market with higher earnings. (Griffin and Ganderton, 1996: 139)

Using data from the 1987 Survey of Recent College Graduates of the U.S., a study by Rumberger and Thomas (1993) examines three sources of qualitative influences on

the initial earnings of college graduates: college major, college quality and college performance. Its results show that all three types of qualitative factors influence initial earnings, but the effects of institutional quality and educational performance are not uniform for graduates with different college majors. (Rumberger and Thomas, 1993:1)

There are studies that provide evidence of inter-occupational, inter-industry, and inter-sector earnings differentials. That is, the rates of return to education are different in different occupations, industries, and sectors, holding human capital variables the same. Using data of fulltime wage and salary earners aged between 16 and 64 years from the 1981 and 1991 censuses in Australia, Preston's study investigates such issues. Based on the results of the study, the determinants of earnings vary between private and public sectors. Males employed in the public sector earned 6 percent more than their private counterparts. There is also considerable variability in inter-industry wage differentials uncovered. The lowest paying industries are Welfare, Agriculture and Wood, and the highest Coal and Oil, Metallic Mining and Insurance. The results provide evidence that occupation also exerts a considerable effect on wage outcomes. After controlling for differences in human capital endowments, demographic characteristics, residential area, sector and industry of employment, the estimates reveal a distinct occupational-earnings hierarchy. (Preston, 1997: 72) The study concludes that while human capital model is a useful framework for the study of wage determination in Australia, it is unable to explain significant and persistent inter-industry, inter-occupational and inter-sector wage differences. (*Ibid.*: 73)

Besides the matter of bias, some studies criticise the assumption of homoscedasticity of Mincerian earnings function. The findings of the study by Wagner

and Lorenz using data from samples of German male full-time workers show that the hypothesis of homoscedastic errors is nearly always rejected. (Wagner and Lorenz, 1988:95) The work of Dougherty and Jimenez (1991: 89), mentioned earlier, also reports evidence of significant heteroscedasticity with respect to schooling and experience in both cases of linear and semilogarithmic versions of Mincerian earnings function. And finally, in a very recent article, Akbari and Ogwang tested the validity of Mincer's semi-log specification of earnings function using Canadian data over the 1980's. Findings based on their experiments, employing four different groups of full-time workers,¹⁵ provide evidence on the rejection of the hypothesis of homoscedastic errors. An important implication of the results of their study, as they make clear, is that testing of hypotheses based on Mincer-type earnings functions may be unreliable if Canadian data are used. Consequently, they argue that past policy recommendations in Canada based on the estimates of Mincer-type earnings function are questionable. (Akbari and Ogwang, 1996: 138)

The problem of bias in the estimates of rates of return to education caused by excluding the relevant variables from Mincerian type of earnings functions, reviewed earlier, echoes the issue of specification error. In that regard, some studies explicitly examine the appropriateness of the function with respect to its assumptions for different countries. The results of such studies provide evidence on the specification problem. That is, while Mincer specified his earnings function in the way that rates of return to schooling is constant between different levels of education and assumed that there is no

¹⁵ Four different groups are Canadian-born males, Canadian-born females, foreign-born males, and foreign-born females. (Akbari and Ogwang, 1996: 135)

cross effect between years of schooling and years of experience, the works of, among others, Psacharopoulos and Layard (1976), Dougherty and Jimenez (1991), Psacharopoulos et al. (1994), Kingdon (1997) and Preston (1997) reveal evidence undermining such assumptions. That is, the rates of return to education vary across educational levels, and there is a significant interaction between years of schooling and years of experience.¹⁶

In what was presented above, it has been demonstrated that (i) human capital variables are important determinants of earnings, (ii) the contribution of human capital variables to earnings (i.e., the rates of return to human capital) varies across occupations, industries, sectors, and geographical areas, and (iii) only some studies incorporated such considerations by using extended forms of Mincerian earnings function. Nonetheless, all empirical studies as such establish a relationship between education and earnings, and their results show a positive relation between human capital and earnings rather than *how* education increases earnings. In the following section we selectively review relevant studies investigating the relationship between education, productivity, and earnings, that is the question “*how* does education increase earnings?”

2.3.2 Education, Productivity, and Earnings: Human Capital Vs Screening

As mentioned in section 2.2.3, the human capital interpretation of earnings differences relying on the assumption of productivity-augmenting role of education has been challenged by some alternative hypotheses such as screening and signalling. Many

¹⁶ There are some other critiques to be mentioned such as the variations of rates of return across time evidenced by, for example, Murphy and Welch (1989) that are beyond the scope of this study.

researchers have attempted to investigate and to criticise the assumption. They have employed various types of methods in their studies that can briefly be categorised as follows:

1. Investigating the relationship between education and productivity (i.e., marginal products) in agriculture and industry;
2. considering earnings of self-employed (compared with those of salaried employees), of dropouts (compared with those of employees who completed their course), or of employees working in jobs which are directly related to their educational qualification (compared with workers with the same qualification but their occupations are not directly related to their education);
3. examining supervisors' ratings of their subordinates (in such studies job performance was used as a proxy for productivity); and
4. addressing the question whether employers reward education for purely informational purposes in their hiring decision.

It is difficult to measure productivity due to the fact that individuals who have completed different levels of education are generally in different types of jobs and producing different outputs (Carnoy, 1994:1693). However, according to most investigations, years of education seem to result in higher output. A survey, conducted by Lockheed *et al.* (1980, *adopted in*: Lockheed, 1987) for the World Bank, of 18 studies that measured the relationship in low-income countries between farmers' education and their agricultural efficiency (as measured by crop production) concluded that a farmer with 4 years of elementary education was, on average, 8.7 percent more productive than a farmer with no education. This survey also found the effect of education to be even greater where complementary inputs, such as fertiliser, new seed, or farm machinery were available (i.e. a modernising environment). "On average, the

percentage gain as a result of 4 years of education was 10 percent higher in a modernising environment than in a traditional environment.” (Lockheed, 1987:115-6) In the United States, Welch studied the farmer response to technological change (new seeds and other new inputs). His study suggests that those farmers with higher education have higher earnings from farming (when other inputs are controlled for), respond more rapidly to adopting new inputs once they are available, and obtain higher yields from the use of such inputs.¹⁷ (Welch, 1970)

Several attempts have also been devoted to investigate the effect of education on productivity in industry. Fuller’s (1970) investigation, for instance, in two electrical machinery plants in Bangalore, India shows a positive effect of education and training on output, especially when that training is in-firm. Min’s (1987) study of academically and vocationally educated workers in a Chinese automobile factory also shows a small, but statistically significant, increase in productivity associated with more education, and a 6-11 percent higher productivity for those with vocational schooling than for those with academic schooling. (Cited in: Carnoy, 1994:1693)

Efforts have been made to study the productivity-enhancing effects of education through comparing, for example, earnings of the self-employed assumed to operate in labour markets where screening cannot take place (as the control group) with those of salaried employees for whom screening may take place. Lower levels of schooling are

¹⁷ The same findings reported by Foster and Rosenzweig (1995) who studied the effects of learning by doing and learning from others on the adoption of new seeds and new technologies. Based on their findings, they state that imperfect knowledge about the management of the new seeds was a significant barrier to adoption and this barrier diminished as the farmer experience with the new technologies increased. (Foster and Rosenzweig, 1995: 1176)

hypothesised for the self-employed since individuals in this group do not have to signal prospective employers with regard to their productive capabilities. Wolpin's study in that respect shows no significant difference in levels of schooling between self-employed and salaried employed, and therefore, it tends to reject the screening hypothesis. (Wolpin, 1977) On the other hand, Riley's investigation suggests that the screening phenomenon is much more likely to occur in some professions (e.g., for teachers and scientists) than in others (e.g., for managers and engineers). (Riley, 1979) The results of Grubb's study (1993) using the same methodology and data from the National Longitudinal Survey of the class of 1972, indicate that vocational Associate degrees are used as screens, as are high school grads; in contrast, the baccalaureate degree does not operate as a signal. Since, as they state, it increases earnings substantially more in non-screened than in screened positions. (Grubb, 1993: 125) Arabsheibani and Rees (1998) attempted to test the screening hypothesis through employing the P(sacharopoulos)-test, which was proposed by Psacharopoulos (1979). The results of their study show that the rate of return to education for the private sector is higher than the public sector in the U.K. and do not support the strong screening hypothesis. (Arabsheibani and Rees, 1998:191) Johnes' study aims to provide evidence on a particular form of sorting behaviour, by offering a new test to the literature and using data from International Social Survey Programme. Its results lend little support to the sorting interpretation of the wage differential between groups of variously educated workers. (Johnes, 1998:665-6)

On the other hand, Katz and Ziderman's study reports evidence of substantial screening effects based on their comparison of educational levels of pairs of screened (employed) and non-screened (self-employed) groups within similar occupational

categories in Israel.¹⁸ (Katz and Ziderman, 1980) However, it may be argued, as Lazear (1977:254) and Cohn and Geske (1993: 61) state, that potential customers may perform a screening function for education which would provide an incentive for the self-employed to acquire or increase their educational credentials.

Arabsheibani (1989) used another method, initially proposed by Wiles (1974), to test screening hypothesis versus human capital theory. According to this method salaries of workers in occupations in which they use relevant educational qualification should be compared to other workers with the same qualification but working in jobs which are not directly related to their education. Based on this method, the screening hypothesis is rejected if a premium is paid to the former group because in human capital theory it is assumed that what is learnt at school is knowledge useful in production. Using data from a random sample of university graduates in Egypt, Arabsheibani found that employers pay a higher premium in starting salaries when education is useful to jobs, which tends to support the human capital view. (Arabsheibani, 1989: 363) However, in that connection it should be assumed that jobs are relatively homogenous and therefore there is no heterogeneity across jobs in terms of, for example, learning opportunity that may affect starting salaries of employees.

Some other investigations, using the same methodology (i.e., comparing earnings differentials of different groups) but employing different units of analysis (i.e., dropouts and their counterparts who completed their course), examine the relationship between education and productivity. Layard and Psacharopoulos' study, comparing the returns

¹⁸ A more detailed survey of these studies is given in: Cohn and Geske (1993: 57-63).

on education of the dropouts with the returns for employees who have completed their course, shows that there are no significant differences in the return to education between these two groups. This empirical evidence suggests that screening is not a major part of the explanation for the question that “why education explain earnings differentials.” (Layard and Psacharopoulos, 1974: 995)

Another group of studies focuses on the issue of supervisors’ ratings of subordinates as a productivity criterion, in fact, to study the relationship between human capital investments and job performance. Medoff and Abraham’s study, for instance, tends to shed some light on the issue. Its conclusions suggest that supervisors’ ratings of their subordinates adequately reflect the subordinates’ true relative productivity in the year of appraisal and it seems clearly that there is a “no” answer, at least for white male managerial and professional employees working at sampled companies, for the question of “whether or not all but a small fraction of experience-earnings differentials can be explained by experience-productivity differentials.” (Medoff and Abraham, 1982: 215)

Little effort has been made to address directly the question of whether employers reward education for purely informational purposes in the hiring decision. Albrecht (1981) in his investigation addresses the question which is, I would say, the key argument of screening hypotheses. Albrecht assumes that an employer is considering applicants for a position who can be characterised by their educational background and by their ‘information level’, i.e. the amount of a priori information the employer has about them. According to the signalling hypothesis, employers need to use education as a source of information about applicant productivities, i.e. applicants cannot be induced to properly self-select by some cheaper means. Therefore, if the signalling hypothesis is

valid, employers will be forced to rely more heavily on education when considering those applicants about whom they have the least information. He decomposed the role of education in the hiring decision into a pure ‘productivity component’ and a pure ‘information component’ for testing the signalling hypothesis through using a two-way analysis of covariance framework with interactions between education and ‘information’. The procedure was applied to recruitment of auto workers by Volvo, the Swedish auto manufacturer. In the case of Volvo’s hiring behaviour Albrecht’s findings indicate no support for the signalling hypothesis. According to his findings, Volvo prefers applicants with more education and (weakly) prefers applicants about whom more information is available, but in the absence of that extra information no significantly different premium is attached to extra education. That is, Volvo does not appear to rely on education for purely informational purposes in the hiring process. (*Ibid.*: 130-131)

Overall, the literature reviewed¹⁹ indicates that various methods have been used to test the validity of screening hypotheses versus human capital theory. On the whole, the results tend to support the view of human capital theory rather than the view that screening is the main function of education. However, most empirical studies as such provide evidence on the fact that there exists a positive relationship between education and earnings. The question in fact is not whether education explains earnings

¹⁹ Another set of studies (e.g., by Ashenfelter, 1993; Ashenfelter and Krueger, 1994) attempts to examine the productivity-enhancing role of education by using data collected from (identical) twins. Their results support the view of human capital theory. Since they use a special set of data, which enables them to control for innate ability and social background, the correlation observed between education and earnings tends to provide a better and more convincing answer than that of other empirical studies mentioned above with regard to the question of “how does education increase earnings?”

differentials but why it does, as Layard and Psacharopoulos (1974) put it. In other words, the core of the debate between human capital theory and screening hypotheses is concerned with demand for (the services of) human capital provided by employers. Therefore, one has to incorporate data from employer side to find out, for example, whether screening is the main function of education or education improves the productivity of individuals. Data from employer side would provide a more appropriate base to examine the productivity-augmenting role of education. Besides, most empirical studies like what were reviewed above failed to include all relevant variables such as job heterogeneity, the quality of education, innate ability, social background, etc. After including such variables, it is more plausible to evaluate the explanatory power of human capital theory versus screening hypotheses. In practice, however, regression techniques lack adequate statistical controls for such qualitative factors. Therefore, they cannot convincingly answer the debate between human capital theory and screening hypotheses. Blinder (1990:4) highlights the same argument in connection with the question “do profit sharing and incentives actually boost productivity, or do they simply attract the most productive workers to jobs where high productivity is rewarded?”

2.3.3 Human Capital Investigation of Earnings in Iran

Attempts to develop the productive capacity of employees through new educational activities in Iran date back to the early nineteenth century, when the Iranian government attempted to obtain the benefits of Western education by sending Iranian students to European universities to fulfil the needs for professional manpower. (Menashri, 1992: 48) Another development with the same motive was the opening of

the first new institution of higher education learning, Dar al-Fonun, on 28 December 1851. Its object, like that of the earlier studies abroad, was to make western technology available to Iranians. It was a polytechnic designed to teach upper-class youngsters western technology and sciences, thereby preparing them for senior appointments in the army and the administration. (*Ibid.*, p. 33) However, it was not until the 1930s that education has been understood as a twofold process: the acquisition of knowledge as well as character formation and training in good manners. It was also believed that education could produce rapid advances in the nation. Following beliefs like this, a more comprehensive formal education system was developed by establishing the Ministry of Education, priority was awarded to elementary education and opening the schools to children of lower classes has been encouraged. So, attending school was gradually becoming more common for all. This process was accelerated and expanded by establishing Tehran University in 1934. A significant growth in scale and diversity of education, especially secondary and tertiary, in response to the changes of modernisation and economic development has experienced since 1940s. Following these developments, the youth have had a choice of undergoing educational activities or entering the labour market.²⁰

Nevertheless, economic analysis of educational activities is very recent and dates back to the early 1970s. Rahmani (1970), for example, attempted to evaluate social and private rate of return to investment in human capital to shed some lights on educational planning in Iran. However, he confines his analysis to five higher education groups as follows:

²⁰ For a more detailed discussion see Iran's chapter.

1. Literature and humanities
2. Sciences
3. Economics and commercial management
4. Agriculture
5. Engineering

Using data from the 1965 labour force survey and the 1966 census as well as public scale wage/salary for temporary civil servants, he estimated an average income of agricultural workers, unskilled workers, skilled workers, technicians, and workers with higher education qualification. Assuming the age of 60 as a retirement age and 25 years of work as working life, and considering 5 percent growth for the initial income of graduates, he estimated age-earnings profiles of the workers. He made some adjustments for tax, ability and unemployment to estimate income attributed to education. Using government budget figures, he estimated the average per student social cost of the five educational groups. He considered the average (pre-tax) income of secondary school graduates as indirect-social cost of education. To estimate private cost of education, he incorporated book and stationary expenses according to his own experience, as the direct cost and average income of a secondary graduate after tax as the indirect private cost.

He finally, applying the conventional formula to calculating internal rate of return, that is (2.2), concluded that private rates of return to higher education were so high (more than 10 percent) that encouraged individuals to continue their education.

$$\sum_{t=1}^{t=T} [(E - C) / (1 + r)^t] = 0 \quad (2.2)$$

where E and C are income and costs of education, respectively, and r is internal rate of return, T is age of retirement and t is age of starting work.

Among the educational groups, he found that engineers could gain the highest rate of return, and, in contrast, graduates of humanity courses had the lowest return to their educational investments. Nevertheless, he still suggested education as an profitable investment for both private and public sectors.

As mentioned above, Rahamani's investigation was based partly on some estimated and artificial figures rather than real ones. This can weaken any applicability and generalisability of the results. Moreover, neglecting other educational levels, he did not incorporate the effects of off-school training, geographical as well as job and sector diversity on earnings of the graduates in his consideration.

Psacharopoulos and Williams (1973) investigated the determinants of earnings differentials (especially the effects of education on earnings) in the public sector of Iran. Their analysis is based on data (241000 observations) from the data bank of the State Organisation for Administration and Employment Affairs (SOAEA) referring to the great majority of public sector employees in Iran in 1971; however, the data bank did not include university teachers, judges, members of the armed forces, and the employees of mixed enterprises like the National Iranian Oil Corporation and Iran Air.

They incorporated basic salary and allowances as earnings of the employees, and age, sex, educational level, and status as the determinants of earnings differentials into an earnings function by means of multiple regression. Running their basic earnings function considering age and education as continuous variables and status (being a

permanent or temporary employee) and sex as dummy ones, they conclude that one year of education, on average, increased earnings by 6 percent; whereas its effect on basic salary and allowances was to increase them by 4 percent and 13 percent respectively. The fact of being a permanent employee added about 41 percent to basic salary but nothing to allowances. On the other hand, the fact of being a temporary employee added almost 100 percent to allowances but 17 percent to basic salary. According to their investigation, the coefficients for "sex" show that whereas being male added only 2.5 percent to basic salary it added 60 percent to allowances.

In the next stage, they extended their experiments by entering age and education as dummy variables in order to allow for possible non-linearities (i.e., the effect of one extra year of university education may be different from that of one extra year of primary education).

They found that earnings functions in relation to age appear to be "S" shaped, rising steeply up to the mid forties, after which the growth tapers off. The coefficients for education according to their experiments increase with each level, with the exception of Ph.D. All education coefficients for unofficial employees are above the ones for official employees.

For the sake of public policy and educational priorities, they evaluated returns to education but, as they acknowledge, in a crude way. They concluded that whereas the social rates of return to education were in all cases below or equal to the private returns, the rates of return were much higher for primary education than for the other levels and that they were particularly low for secondary education.

Although Psacharopoulos and Williams' study is one of the most systematic to investigate the relationship between earnings and education in the context of Iran's economy, it lacks sufficient information to justify the methodology employed, and appropriate explanation of the results and the behaviour of some variables employed. Regarding the first point, it is worth noting that they did not provide enough information, for example, of using the average earnings of three-year age groups as "earnings" variable to see whether the age groups of each year were the same grouped individuals or not. Furthermore, they did not justify using the semi-log rather than any other form of earnings function in their investigation.

Overall, they focused mainly on the extent to which education and the other variables employed contribute to increasing the earnings of the employees. They could, however, have presented a human capital explanation and interpretation illuminating how the determinants explain the earnings differentials. For example, the coefficients for "sex", as Psacharopoulos and Williams point out, evaluate the effect of gender on earnings, which show that being male increases basic salary only 2.5 percent whereas it adds 60 percent to allowances. They interpret this behaviour of the variable in the way that there was virtually no discrimination against women in official pay scales, but the operation of the labour market meant that in terms of earnings men receive considerably more than women. However, women's investment in human capital through on-the-job training would be one of the main factors that can explain, in part, the differences in a more reasonable way. That is, it is more reasonable to hypothesise that women invest less than men in themselves through on-the-job training due to having more, for example, work experience interruptions. Age is also another determinant involved in their investigation that they did not provide sufficient explanation for its behaviour.

Finally, the study is confined to public sector employees. In the public sector it would be the case that employees are paid based on their educational qualifications rather than their productivity.²¹

2.4 Summary and Critique of the Methodological Underpinnings of the Empirical Work

In the above sections, we have reviewed the theoretical underpinnings of the individual investment behaviour towards the human capital and the incentives to undergo educational and training activities. An attempt was also made to comment on empirical studies applying Mincerian earnings function. We have briefly reviewed the behaviour of firm investment in human capital and the neo-classical theoretical consideration of the willingness of employers to pay more to more highly educated workers. It has been found that there is a widespread view among economists (under individual investment behaviour) that spending on education and training is more an investment activity than a consumption one. Some other social scientists, however, have provided rather different explanations for the behaviour such as screening and signalling hypotheses arguing that an individual undergoes educational activities to signal his pre-

²¹ It should be mentioned that during past few years, a few studies conducted evaluating the rates of return to education using cost-benefit analysis technique. To evaluate the benefits of education they used public salary schedules rather than real figures on earnings of graduates. For that reason we did not present such studies, which are Master degree dissertations, in this section. A study by Henderson (1983) also examines the question whether the systematic exclusion of 'own-account' workers result in an upward bias in the estimated rates of return to schooling. Using data from a 1975 socio-economic survey conducted in Tehran and based on his findings, he concludes that "in contradiction to conclusions drawn from Chiswick's (1976) study, the high rates of return to schooling found in many studies of less-developed countries do not appear to be the result of the systematic exclusion of the self-employed from the estimating samples." (Henderson, 1983:97)

existing ability. These alternative views, therefore, mainly attack the productivity-augmenting role of education but they do not weaken the interpretation of education as a private investment.

In terms of the empirical investigation of human capital theory, it has been found that some studies appear to confirm the superiority and especially the semi-log structure of the Mincerian earnings function that dominates the investigation of earnings differentials in the context of human capital theory. On the other hand, the standard and basic form of the function, for the purpose of the estimation of rates of return to education, has been criticised because it ignores other factors influencing earnings. For example, education and training are key variables in connection with studying earnings differentials, theoretically. In practical and conventional empirical terms, however, it is years of schooling and of experience, which have been employed as proxies to measure education and training variables. In such circumstances, a variety of heterogeneities like heterogeneity in innate ability, quality of education and training (experience), social background, etc. that in reality, as Becker remarked in his theoretical consideration, exists and affects both human capital accumulation and earnings would remain excluded. This exclusion would lead to a situation where the error terms and the other explanatory variables are correlated, which raises the issue of bias and relaxes one of the basic assumption of ordinary least squares (OLS) technique²² that has been used extensively in the literature. Most empirical studies fail, partly due to lack of data, to incorporate such relevant predictors in the analysis. Little effort has been made to evaluate the extent to which these factors affect earnings variation.

²² More discussion is provided in, e.g., Maddala (1992:253-54).

As evidenced in the literature, the relationship between human capital variables and earnings is not the same across occupations, firms, economic sectors, industries, geographical locations, etc. These kinds of heterogeneity raise another econometric problem (i.e., heteroscedasticity) in which the variance of the error term in an earnings equation does not remain constant, as assumed in the conventional OLS estimates. As a consequence, the OLS estimates would be inefficient and may mislead us in testing of hypotheses. Quite recently, this issue has attracted some attention²³ but little effort has been made to examine and detect the sources of such a problem. Moreover, such variations in the relationship may be of interest to be investigated. For example, it would be very informative, in terms of policy implications and/or theoretical investigation, to examine the question of *why* the contribution of years of schooling to earnings is more in some occupations, firms, etc. than in others, holding human capital variables constant. These kinds of consideration remain another uncharted territory.

It is conventional that to estimate years of experience (i.e., potential years of experience) a researcher subtracts "years of schooling and age of starting school" from age of an employee and assumes that a graduate would start his working life immediately after graduation. However, this measurement would be a very crude estimation of investment in human capital through experience in the context of economies like developing countries, which experience a high rate of unemployment and/or a low rate of literacy. That is, the assumption that a graduate starts his/her

²³ For example, studies by Wagner and Lorenz (1988), Dougherty and Jimenez (1991), and Akbari and Ogwang (1996).

employment immediately after his/her graduation would be unreasonable and perhaps unrealistic.²⁴

Furthermore, in the conventional way, years of schooling have been considered as the proxy for education in the way that the effect of one school year in primary level contributes to increasing earnings as much as one school year in tertiary level. However, as Bowman (1968: 247) has highlighted and some empirical research has shown, a year of elementary schooling is not economically the same as a year in, for example, college education.

It is also argued that more educated people can invest in themselves more than less educated ones through (on-the-job) training. This means that there is a positive relationship between schooling and post-schooling investments, which justify partly the increasing gap between earnings-experience profiles of different educational levels. Nevertheless, the Basic Mincerian earnings function and many other empirical investigations fail to provide evidence to support such an important consideration.

Finally, the literature reviewed shows that most criticisms of human capital analysis of earnings differentials focus on bias in the evaluation of the effect of education on earnings. So far, however, little effort has been made to examine the matter of the efficiency of the estimates. That is, it has not been considered whether the estimates have minimum variance and, therefore, are reliable for hypothesis testing.

²⁴ A study by Arabsheibani (1996:10) highlights this issue as measurement error in the calculation of the “potential experience.”

The above mentioned criticisms of studying returns to investment in human capital and evaluation of effects of education and training on earnings, in my view, stem from two sources; the lack of appropriate measurement and, in turn, data, and weaknesses in the methods of analysis. The matter of data and errors measurement has long been a problem in empirical economic studies. Broadly speaking, three types of errors can be identified in this connection:

- Recording errors
- Response or sampling error
- Errors due to using an imperfect measure (i.e. proxy variables) of the true variable, which is often not measurable and is called “latent” variables. (For more discussion see: Maddala, 1992: 448; Griliches, 1986: 1476.)

The major part of the criticisms, it would seem, relates to the third type of errors, though it is also very likely that other errors occur when the methods of data collection are survey and questionnaires. In the case of human capital where the variables consist of education in school, off-school education, health care and job searching, these variables cannot be measured directly. Researchers often use some relevant proxies for that purpose. In the case of education, for example, various proxies have been used such as schooling years and school quality. However, there are also some other factors such as household investments in their children during schooling periods, effects of educational system, and the like which can affect the measurement of the real effect of education on earnings.

Furthermore, when we assume that education can be more effective in increasing earnings in a more complicated and highly technological situation, in a bigger

enterprise, etc. it means that such variations in the contribution of years of schooling to earnings are, as human capital theory predicts, the outcome of variation in human capital accumulation. Therefore, there will be scope for further investigation to measure the effects of education on earnings more accurately. So far little attention, if any, has been devoted to these kinds of consideration. The reasons for ignoring these factors are threefold; the first can be attributed to the fact that different units of analysis (e.g., individuals, firms, industries, etc.) are, in practice, involved in human capital analysis of earnings differentials. Through using a single-level of analysis like OLS, a researcher has to choose only one kind of unit and the effects of the characteristics of other units would remain excluded.²⁵ The single level method, therefore, can provide a very crude model of any *reality*, which dominated by a hierarchical structure.

The second reason is concerned with using data grouped across individuals, firms, industries and geographical areas. Human capital theory focuses on the behaviour of individuals (employees or employers). These individuals are heterogeneous in terms of their embodied human capital and earnings. The above mentioned factors (i.e. firms, industries, etc.) also affect both human capital and earnings and, therefore, are very important to be investigated in the human capital analysis of earnings. That is, as Mincer (1974: 80) remarks, the observed profiles of earnings differ a great deal among specialities and types of employers that may be of interest. Grouping which can be provided across individuals, firms, industries, cities, etc. removes such sources of heterogeneity. There would, thus, exist a contradiction between grouping data, which is

²⁵ It should be mentioned that through using dummy variable technique it is possible to include some limited aspects of the characteristics of other kinds of unit. Discussions concerning the units of analysis and econometric problems are given, e.g., in: Barker and Pesaran (1990).

very common in the conventional approach of analysis, and achieving a satisfactory stage of measuring the effects of education and other variables on earnings.

And finally, the third reason is the lack of an appropriate analytical approach, which allows the researcher to incorporate such kinds of heterogeneities. A single-level approach of analysis, as mentioned earlier, is very restrictive in this respect.

Interpreting how education and training explain earnings differentials, most economists, as Carnoy (1994: 1694) points out, agree that there is a positive relationship between education and productivity but providing convincing evidence has been an elusive enterprise. The review of empirical studies of human capital investments and productivity has revealed that education and training have positive and significant effects on productivity. On the other hand, studies that compare earnings of a screened group (e.g., the employed) with those of a non-screened one (e.g., the self-employed) show conflicting results though with a tendency to support human capital theory. While attempts to link education to productivity through using supervisors' ratings tend to support screening and signalling hypotheses, the approach examining the question of whether employers use education for purely informational purposes in their hiring decisions, applied for the case of the Swedish auto manufacturer Volvo, provides no support for the signalling hypothesis.

To test the screening hypotheses versus human capital theory most studies have employed indirect methods that are mainly useful to establish the relationship between education and earnings. The core of the debate between human capital theory and screening hypotheses, however, is concerned with productivity-adding role of education, which directly relates to the demand rather than the supply side of human

capital. That is, data from employers is needed to examine the debate. Moreover, the alternative theories could not provide a satisfactory explanation, particularly as they fail to take into account other forms of investment in human capital such as out-of-school education and training, job searching, and investment in human capital by employers.

The main reasons for the conflicting results from the empirical studies examining the debate between human capital theory and its rival hypotheses may rely on the fact that the relationship between investments in human capital and productivity is not properly understood (Mace, 1984: 42) and/or the conventional methods of investigation used perhaps cannot provide satisfactory results in that respect. With regard to the latter case, it can be stated that regression techniques, in practice, lack adequate statistical controls for qualitative factors such as innate ability, quality of education/experience, motivation, etc. Therefore, they cannot convincingly answer the debate between human capital theory and screening hypotheses.

Furthermore, the reasons why employers offer more wages and salaries to more highly educated employees and why employers, as Williams (1978: 364) remarks, should emphasise educational qualifications in the selection of employees for (high-level) jobs has not been investigated properly.

In the case of Iran we have briefly reviewed attempts to develop the productive capacity of human resources through new educational activities. We have found that these activities date back some 200 years. However, a systematic economic analysis of the activities is very recent and very rare. Especially, there is no study that investigates the determinants of earnings and the relationship between education, training and earnings in the manufacturing sector of Iran's economy.

The main purpose of this chapter, after reviewing the theoretical underpinnings of investment in human capital, was to demonstrate that regression analysis technique (i.e. OLS) used extensively, during past three decades, in order to evaluate the rates of return to investment in human capital faces serious statistical problems, which may affect both the extent of rates of return to human capital measurements and the reliability of testing of hypotheses. Such issues are very important in terms of policy implications. In the next chapter we propose to examine alternative methods of data collection and analysis that can improve the accuracy of estimates and provide a more appropriate and detailed interpretation and explanation of results.

Chapter 3 Research Methodology

3.1 Introduction

This study, as mentioned earlier, focuses on an investigation of the relationship between investments in human capital (education and experience) and increasing earnings with special reference to the manufacturing sector of Iran's economy. The relationship will be examined through regressing the characteristics of employees and firms on earnings by employing an earnings function consisting of educational qualifications, experience and enterprise as the main explanatory variables and earnings of employees as the dependent variable. Furthermore, the reason *why* higher education leads to higher earnings will also be studied through conducting interviews with senior managers.

In this chapter we discuss and elaborate how our research questions are investigated. We start this chapter by addressing the research questions and sub-questions. In the second section, the relevant concepts are discussed and a discussion and justification of units of analysis as well as variables employed are presented in the

next two sections. Then, methods of collecting data are elaborated and justified. Finally, methods of analysis are introduced and justified in the last section, which also contains a discussion of a proposed experimental statistical procedure.

3.2 Research Questions

The research questions and sub-questions that are investigated in this study are as follows:

1) Do investments in human capital through education and experience lead to higher earnings in the manufacturing sector of Iran's economy? If so, to what extent?

To what extent does education contribute to increasing earnings? To what extent does experience increase earnings compared with education? In the context of the manufacturing sector in Iran are years of schooling more appropriate to account for earnings differentials attributed to education, or educational levels? Is the estimation of years of experience in the conventional way (i.e., *age minus age of starting school minus years of schooling*) an appropriate measurement for investment through training (experience) in the context of the manufacturing sector?

2) Is a multilevel analysis a more appropriate approach than the conventional OLS one for evaluating the effects of investments in human capital on earnings?

Are there any advantages for the multilevel method in applying earnings functions in the context of human capital theory compared with a single-level one? What criteria should be considered to explore the advantages of multilevel techniques? Are data used

dominated by a hierarchical structure? Are the effects of education and experience on earnings the same in different firms and in different geographical localities, holding constant human capital variables? What statistical problems arise due to ignoring cluster effects on earnings that may be explained partly by firm level variables such as size and nature of firm and geographical location?

3) Is the contribution of human capital investments to increasing earnings, if any, due to the productivity-augmenting role of education or does education serve as a “screening” device, identifying more able people?

3.3 Concepts

The main purpose of this study is to investigate the extent to which investments in human capital through education and training lead to increasing earnings. For that purpose a single level method (i.e., applying ordinary least squares) and a multilevel approach (based on random coefficient models) of analysis are employed. In what follows we discuss the main concepts involved in this study.

Education is defined as development and improvement of knowledge and intellect through the formal education systems (schools and universities). This concept will be measured by either years of schooling and/or educational levels.

Training means development and improvement of knowledge and intellect through informal systems such as on-the-job learning, measured by years of experience, on-the-job training and off-the-job training, measured by hours of training.

An *employee* is a full time-male worker working in one of the selected firms.

Earnings consist of wage/salary and any other payment such as accommodation and food benefits, allowances, etc. that an employee earns from the main employer during a specific period, for example, a year.

A *firm* is an institution in the manufacturing sector that buys or hires inputs (i.e. labour, capital, and raw materials) and organises them to produce and sell its output (goods or services) to maximise its benefits (profit, sale, etc.).

A single-level method of analysis: At a single-level of analysis the data from different groups, firms, etc. are pooled and a single analysis is carried out between all, for example, employees in the total sample. In symbols, a regression analysis of this type with one explanatory variable can be stated as follows:

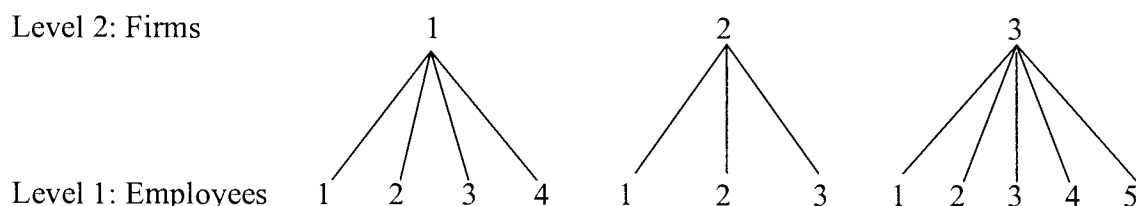
$$y_i = \alpha_0 + \alpha_1 x_i + e_i \quad (3.1)$$

where y_i is the dependent variable, an individual's earnings; x_i is an explanatory variable, say years of schooling of the individual; and e_i is error term or, more precisely, random effect and the effects of omitted variables, if any. It is assumed that the residuals are uncorrelated across the observations. In this method of analysis the effects of clustering on earnings are ignored; and it is assumed that the groups have a similar effect on all workers' earnings. (For an extended model under a single level of analysis see section 3.7.)

A multi-level method of analysis: At a multilevel of analysis the effects of groups are taken into account. In such a consideration, it is believed (Goldstein, 1987, 1995) that

social and many other systems typically have a hierarchical organisation in which 'units' at one 'level' are grouped and clustered within units at the next higher level. In work settings, for example, workers are grouped and clustered together for production within factories/firms. This gives, at least, two levels; the lowest or level 1 being that of the workers; the level two being that of the firms. (Diagram 3.1 depicts such a two-level model.) If one is interested in the factors which influence workers' earnings through a multilevel perspective then among those factors, he will generally wish to include the characteristics of the workers themselves, such as education, experience, etc. as the first level variables and those of their enterprises, such as size of the firm, geographical location, etc. as the second level variables. (It is postulated that the firms operate in a non-competitive market and, therefore, the effects of firm characteristics on earnings are not the same.) It is worth noting that in this method of analysis the reduced form of the equations has two or more error/residual terms and the residuals of observations in the same, e.g., firm are correlated to each other. In contrast, the residuals of observations in different units of the second level are still assumed uncorrelated. (More details are given in, e.g., Goldstein, 1995; and Woodhouse *et al.*, 1995.)

Diagram 3.1: Two-Level Model



Let

$$y_{ij} = \beta_{0j} + \beta_{1j}x_{ij} + e_{ij} \quad (3.2)$$

$i=1,2,\dots,n_j$ and $j=1,2,\dots,m$

be the regression equation, where y_{ij} are (log of) earnings (of higher level of education), β_{0j} intercept or (log of) earnings of lower level of education, x_{ij} individual characteristics (human capital proxies), e_{ij} error terms at level 1, n_j number of employees working in firm j , and m number of firms.

If there are some variables, z_j , that can explain the variation of β_{0j} and β_{1j} across the enterprises, we can write:

$$\beta_{0j} = \beta_{00} + \alpha_1 z_j + u_{0j} \quad (3.3)$$

$$\beta_{1j} = \beta_{10} + \alpha_2 z_j + u_{1j} \quad (3.4)$$

where z_j are cluster/firm characteristics, and u_{0j} and u_{1j} are error terms (residuals) at level two. Substituting these in Eq.(3.2), we get

$$y_{ij} = \beta_{00} + \beta_{10} x_{ij} + \alpha_1 z_j + \alpha_2 z_j x_{ij} + (e_{ij} + u_{0j} + u_{1j} x_{ij}) \quad (3.5)$$

where $\partial y_{ij} / \partial z_j = \alpha_1 + \alpha_2 x_{ij}$ are the marginal effects of group characteristics on earnings and β_{10} the (direct) contribution of the human capital investments to increasing earnings.

3.4 Units of Analysis and Sample Selection

This section begins with discussion of the selection of the sample of employees and firms that are the units of quantitative analysis. Then, the selection of interviewees that are the units of qualitative analysis is discussed.

3.4.1 Sample of Employees and Firms

In the quantitative part of our investigation, the units of analysis due to employing a particular methodology (i.e., a multilevel analysis) are of two different kinds; the units

of the first level of analysis are all full-time male workers in the selected companies. It is the full-time workers not part-time ones that the investigation is concerned with because data regarding experience of part time employees is usually not available. We also focused on male workers' situation rather than both male and female employees for two reasons; female workers normally in acquiring their human capital through experience are faced with more interruptions and discontinuity than men. (Mincer, 1979: 17) The information about these interruptions and discontinuities are rarely available. Moreover, female employees have mainly been employed in the public sector of Iran and due to the nature of activities in the target factories the proportion of female workers is very low compared with that of male workers and we would, therefore, not have sufficient number of observations to run a separate earnings function for female workers in each company.

In the second level of analysis, the units are the firms/enterprises at which the employees (i.e., the units of first level) are working. Each enterprise is considered as one observation at this level. The companies were selected from the (medium-size) modern manufacturing sector of Iran.¹ The preference for the manufacturing units is three fold: First, the units of manufacturing sector are large enough, in terms of the number of full-time male workers, to run a separate earnings function for each firm.

¹ It is worthwhile noting that the manufacturing sector in Iran comprises firms employing a wide variation in the number of employees; ranging from a firm with no salaried employee to a firm with thousands of employees. Firms employing 50 or more workers are defined as large firms. What we mean by modern manufacturing units is the units that make goods on a large scale using machinery. In this study, therefore, the (traditional) manufacturing units that are usually classified as small units are excluded. Very large firms and enterprises that are involved in oil and heavy industry are also not included. (More details about the composition of manufacturing units in Iran is provided in chapter 4.)

Second, their employees usually have a range of qualifications (both educational and training ones) and therefore these units could be more appropriate to study the relationship between human capital variables and increasing earnings. Finally, the units usually have better and more organised personnel information and it was, in turn, more likely to collect a sufficient number of observations to conduct our investigation by employing a two-level model of analysis.

Thus, finding the appropriate cases within the units of manufacturing sector was a major issue at this stage. For this we had initially a puzzle which, on the one hand, we *did* need a large number of observations (both employees and firms) to conduct a multilevel analysis. On the other hand, we had to collect the data under the situation of limited resources. In these circumstances, designing questionnaires and distributing them among a large number of units (e.g., 10,000 employees and about 70 companies²) to collect the data were impossible. Because it would be very time consuming for such a large number of observations and almost impossible to have a random sample of employees and firms from the manufacturing sector. The possibility of the collaboration of employers to distribute and to collect the large number of questionnaires was very low. The matter of returning a sufficient number of questionnaires, which would consist of a variety of educational qualifications, years of experience and other relevant factors, was another important factor in the selection of sample.

² The recommended number of higher level units of analysis is 30 or more. Assuming the rate of response at 40-50 percent, we had thought of 70 firms as higher level units for the fieldwork and conducting a two-level of analysis.

The alternative method was to have access to employees' file data. This way has advantages compared to distributing questionnaire among employees, besides not having disadvantages the latter approach. It would be possible to have data of all full-time male workers, instead of a selected sample, who have a variety of qualifications. Having access to the file data also reduces errors in response, recording, etc., which are very important in the estimation of the effects of human capital variables on earnings differentials.³ However, the selection of units of level two remained the main issue at this stage. It should be emphasised that in order to examine the second research question, it was extremely important to select the units of level two in a way that reflect the issue of clustering in the real world.

To overcome the above-mentioned problems and to find the most appropriate units/cases, we had to go to Iran (i.e., the field) and began to consult some experts⁴ in the manufacturing sector. We thought that focusing on manufacturing firms located in a big city would be appropriate for our study. However, the findings of meetings with the experts who had experience in data collection from such firms (e.g., conducting industrial surveys and censuses) showed that we should not confine our case study only to a single city. Because, according to their experience, the companies would not

³ More detail is given in chapter 2.

⁴ Our first meeting of this kind was with an expert in economics (holding MA/S in economics) employed in public sector (in Mashhad an eastern city of Iran), and as a part of his official tasks he collaborates with the member of Statistics Centre of Iran in conducting industrial censuses and surveys. The second meeting was with two other experts in economics in Tehran who are involved in the manufacturing sector issues and policies.

properly collaborate with us in the data gathering. Besides the meetings, we had also studied relevant-published documents regarding the manufacturing sector of Iran.

So at this stage we had arrived at the point that we should contact some organisations and official authorities that would have authority and power in relation to a large number of firms in the manufacturing sector in Iran. After considering some organisations, we were advised and introduced to one of the most appropriate organisation (i.e., the Organisation of National Industries, ONI, affiliated to the Ministry of Industry) which has had a close managerial relationship with more than 70 mixed (i.e., private and semi-private) companies in the manufacturing sector.⁵ In fact, the government in some cases is one of the shareholders and the matter of allocating foreign exchange for the importation of companies is also another policy instrument to strengthen the relationship. These companies are, however, independent in their employment policies and, seeking profit maximisation through market mechanisms, have also a wide range in the number of employees ranging from 20 to 2000 personnel. The firms, therefore, were regarded as appropriate cases and clusters for studying the effect of clustering on the estimates of human capital variables and of firm size on earnings. The companies are also located in different geographical areas of Iran so that this element, accompanied with the size of firms, can be considered as two key variables of the second level of analysis. Their employees have also a variety of educational

⁵ Other alternatives were possible to choose. For example, it was possible to contact a holding company to collect data of the characteristics of its employees and factories/firms. However, we did not find a holding company that had 30 or more firms/factories that would be appropriate for examining earnings differentials through employing two-level models.

qualifications as well as years of experience which this variety enables us to test the key ideas of human capital theory.

We, then, began contacting some general managers of the organisation and in turn were able to establish some meetings with them as well as with some senior experts in some departments of the organisation who have been completely familiar with the situation of the companies. In these meetings we had discussed the aim of study and the data needed. So we could have their agreement and collaboration in collecting the data. As mentioned earlier, the target firms were regarded as appropriate clusters for human capital study of earnings differentials through employing two-level models, which would enable us to examine the variation of contribution of human capital variables on earnings across the firms.⁶ Although the firms are not a random sample from the manufacturing sector or the Iranian economy and this may weaken the generalisability of results to the whole economy, our findings can provide evidence of the fact that (i) data used are dominated by a hierarchical structure, and (ii) in a hierarchical system the OLS approach employed extensively in empirical studies is not appropriate and may give misleading results. Therefore, our findings of the contribution of human capital variables to earnings would help us to provide answers for the first set of research questions. Such findings would be generalisable to the situation of other firms whose main objective is profit maximisation.

⁶ More details about the characteristics of the sample are presented in chapter 5.

3.4.2 Sample of interviewees

To supplement the quantitative analyses and to explore further the relationship between investment in human capital, earnings, and productivity, we conducted interviews with employers or their representatives. By this means it is possible to explore whether employers see and regard investments in human capital, in general, and education, in particular, as a productivity-augmenting phenomenon.

The interviewees were chosen from the staff of the firms who were responsible for making and implementing their company's pay practices, and employment and training policies. Therefore, the target people have been the chief executive or a member of management board, administrative deputy, personnel manager, and/or training department manager of a firm, because such persons were regarded as appropriate interviewees whose responses could help us to examine the third research question. With regard to the number of interviewees, the main purpose was to choose as many as possible such people for interview. Given our resource constraints, the target firms were, however, confined to the cases where the firms have had a representative (office) in Tehran or Mashhad. As a first step, we had to meet the chief executive to obtain his agreement to interview his colleagues for further information. During distribution of the questionnaires of quantitative data, attempts were made to arrange meetings with the appropriate staff. We also contacted them through telephone for an appointment. The details of interviewees and data collected are presented and analysed in chapter 7. Data derived from this sample would complement those of our questionnaires by exploring the complexity and the heterogeneity involved in working places in terms of human

capital accumulation and the relationship between human capital variables, earnings, and productivity. The results would shed light on the third research question.

3.5 Variables and Questionnaires Design

Various sources have influenced the choice of variables for this study; human capital theory, previous empirical studies, the particular methodology applied and information gathered in pilot fieldwork⁷ before the main data collection. Human capital theory and relevant empirical studies are concerned with two kinds of variables; human capital variables and earnings. In terms of human capital variables, as mentioned above, this research focuses on education and training.

Education, as one of the main elements of human capital in the context of Iran's educational system, can be measured in two ways; years of schooling and educational level. The number of years of schooling refers to the years that employees spent in educational institutions such as primary schools, secondary schools and colleges or universities. Educational level consists of four levels of education; primary, orientation, secondary, and tertiary.⁸ Data of educational qualifications reported in the

⁷ The main purpose of pilot fieldwork was to evaluate the appropriateness of the questionnaires designed. More discussion in that respect will be presented later in this section. (A copy of the questionnaires is included in Appendix 2.)

⁸ Primary school begins after the age of six and lasts five years. Then, and after finishing the five years successfully, a student follows a guidance or orientation course lasting three years. These eight years of schooling are assumed to be general education. Secondary education lasts four extra years. The course of tertiary level in the Institutions of Higher Education usually lasts 2 years for upper-diploma, 4 years for Bachelor of Science, 6 years for Master of Science/Art as well as for medical, dental, and veterinary courses, and 8 years for PhD. There is also literacy programme for adults which is composed of two parts; the preliminary and the complementary. The preliminary stage is equivalent to two years of schooling at primary level and the complementary to four years of schooling at the primary level. (Further elaboration is provided in chapter 4.)

questionnaires as levels of education can be converted to years of schooling, or vice versa, using the information from Iranian educational system elaborated in chapter 4.

The subject of study was also included in the questionnaire because we assumed that employees with different educational background, in terms of subject or college major, earn differently, holding other characteristics of employees the same. However, only some companies provided such data, and in practice we could not use this incomplete data for the purpose of quantitative analyses.

Although the quality of schooling is an important element of human capital, it is hard to measure so we did not attempt to measure it. However, the application of multilevel technique enables one to evaluate the extent to which the unmeasurable variables, such as the quality of schooling, may contribute to the variation of the contribution of years of schooling on earnings. This issue is elaborated in section 3.7.1.2, Methods of Analyses.

Training as another element of investments in human capital is considered in three dimensions; on-the-job learning, on-the-job training, and off-the-job training. On-the-job learning contributes to human capital accumulation through experience in carrying out an operation and familiarity with techniques as a result of experience. This element of human capital is measured by years of experience. It is conventional that years of experience are measured by subtracting "age of starting school plus years of schooling" from 'age' of employees. In this study, however, attempts were made to have the real figures of years of experience. Actual (years of) experience consists of two parts; experience inside the current company (i.e., internal experience) and that outside the

current working place (external experience), so the years of experience inside can be regarded as the relevant experience and then it is possible to make a comparison between effects of the inside and outside experience on employees' earnings. By employing actual years of experience we in fact relax one of the basic assumptions of the empirical human capital analysis of earnings that students start their working life immediately after graduation.

The age of employees was also included in the questionnaire to estimate the years of experience for the cases where appropriate information directly on years of experience were not provided. In that respect, it should be noted that some companies did not provide information about their employees' years of experience outside their own company perhaps because of lack of such information. To fill the gap, information of age was used. In addition, maturity with age is another factor that may create earnings variation. Including age in an earnings function would account for such variations.

Training on/off the job, as elaborated in chapter 2, is another source of investment in human capital, which contributes to productivity and earnings of employees. On-the-job training consists of any training on-the-job under the supervision of a supervisor, and off-the-job or specific training consists of any training course that the employees have had, related to their current job, in working place or in any educational establishments in both private and public sector. The employers were asked to give us data in connection with training of their employees in any measurement (i.e., hours of attendance, months, course, etc.). Information about training would enable us to

evaluate the effect of investment in human capital through training on employees' earnings. Unfortunately, only some firms provided data on training and, therefore, we could not include a variable for all observations in earnings functions to account for earnings differentials attributed to training, unless for a specific firm that data on training was provided. However, training data is also useful for the qualitative analysis.

Besides the human capital variables, information about some other characteristics of employees such as marital status, job situation and working conditions was collected. Although these variables are not directly concerned with human capital theory, they may affect the results of studying the relationship between human capital variables and earnings differentials. Marital status, job situation and working conditions, for example, may not contribute to human capital accumulation but they may influence the earnings of employees. With a given level of human capital, non permanent employees may earn more money partly as a risk premium due to lack of non-pecuniary benefits of their job such as job security and promotion expectations; employees who work in difficult conditions, at night, or as a shift worker receive more wages and salaries. Although, we had hoped that data on such factors would be provided, only data on marital status and job seniority were provided by all firms and data on the other factors are incomplete. Empirically, due to employing hourly earnings and the fact that almost all employees were married, only job seniority is incorporated in our earnings functions. Incomplete data of other variables, however, are useful for an explanation of extreme values (outliers).

Job title, as mentioned above, was also included in the questionnaire in connection with the belief that a part of earnings differentials is attributed to job heterogeneity. Particularly, it is expected that supervisors and managers receive more earnings for their extra responsibilities. In this connection, we also assumed that jobs such as management and supervision provide a better opportunity for human capital accumulation. Besides, educational qualification and experience are two important factors that determine access better jobs. Therefore, data on job seniority can help partly to evaluate the option value of education and experience to access better jobs.

Data about earnings, as the dependent variable, include (gross) annual earnings so that we are able to evaluate the effects of human capital on (gross) earnings differentials. We employ hourly earnings instead of annual earnings as the dependent variable in that some employees started their working life, for example, at the middle of the year and also because of the lack of information regarding earnings of second and third jobs, if any, of the employees. Hours of work (especially overtime hours of work) in the main job also vary among employees with different educational qualifications. For example, it may be the case that less-educated workers mainly work with one employer and, therefore, their overtime hours of work in their current working place are more than those of more highly educated workers. Thus, it seemed more reasonable that hours of work in the main job be also included in the questionnaire to collect appropriate data regarding both usual and overtime hours of work to calculate hourly earnings of the employees.⁹

As mentioned earlier, one of main purposes of this study is to evaluate the appropriateness of multilevel methodology in the human capital analysis of earnings.

⁹ A more detailed discussion concerning the appropriateness of “hourly earnings” for human capital analysis of earnings is provided by Blinder (1976:12).

This methodology dictates that data of different units of analysis should be collected, depending on the number of levels of analysis. In this study, a two level method, consisting of employees as level 1 units and firms as level 2 units, is employed. Data regarding the second or higher level of analysis was collected. Units at the second level are firms or enterprises in the manufacturing sector; the size of firms, geographical locality, and type of industry are considered to be the main explanatory variables at this level. Including these variables in this analysis is not because they are a major concern of this study, but because ignoring such variables would lead to some statistical problems, as elaborated in section 3.7.1 of this chapter, which may mislead the results and, in turn, conclusions of the analysis. Besides, the cluster effects (i.e., earnings differentials attributed to firm level) may help to explore new aspects of human capital investment such as externality effect of human capital density. For that purpose we employ some contextual variables such as the average stock of human capital in each firm to find out whether the employees working in a firm with higher human capital density are paid more. Including firm level variables through applying a multilevel methodology also helps to find the real explanatory variables at firm level.

To be aware of the factors that influence earnings of the employees in further detail, before conducting the main data collection we also studied some employment contracts, wage/salary lists, and visited two firms to check the appropriateness of our questionnaires with the staff of the firms who were involved directly in personnel and administrative departments. Initially, we had been introduced to two companies located in Tehran to have meetings with managers and officers in the companies to find out the

most appropriate way of collecting the required data. In the meetings aims of the study were discussed and variables employed were reviewed. The staff were also asked concerning any other factors that affect earnings of their employees. With the assistance of such persons, two questionnaires, each consisting of the variables of one level of analysis elaborated above, were revised and finalised for distribution. The two questionnaires were photocopied (a copy of the English translation of the questionnaires is included in Appendix 2) with two letters, an introductory one from the researcher highlighting the purpose of the study and making the point that data would remain confidential to facilitate providing data, and another from the organisation introducing the researcher to the companies. We thought that the situation of different firms may not necessarily be the same and that people in different firms may have different interpretation of the items included in the questionnaires. To solve any possible ambiguity in answering the questionnaires, we allocated two telephone numbers for possible contact with the researcher or his assistants.

3.6 Interviews and Collecting Qualitative Data

To supplement the quantitative analyses and to explore further the relationship between investment in human capital, earnings and productivity, interviews with senior managers of the selected companies were held. By this means it is possible to explore whether employers see and regard investments in human capital, in general, and education, in particular, as a productivity-augmenting phenomenon. Moreover, since the sample of employees was selected from a relatively homogeneous set of firms and

employees, it is not possible to decompose the observations into two groups of screened and non-screened workers, as Wolpin (1977) suggests, in order to study and test the validity of the assumption of human capital theory or the view of screening hypotheses.

As mentioned above, interviews with the senior managers of selected companies who were responsible for their company's wages and salaries, employment and recruitment policies, and training programmes were conducted to find out:

1. Do the employers consider education and training (ET) as productivity-enhancing factors in their recruitment policy and training programmes?
2. Is there is a link between ET and earnings of their employees?
3. How can the extreme values of earnings be explained?

For the purpose of collecting this qualitative data, a semi-structured questionnaire was designed. (A copy of the questionnaire is provided in Appendix 3.) The first part of the questionnaire is concerned with educational qualifications. Questions of this part are to find out whether employers use educational qualifications as a screening device to select more able individuals or they have greater expectation of education. In the second part, the behaviour of employers concerning human capital accumulation through experience is considered. We also sought to explore partly the heterogeneity involved in human capital accumulation across different jobs. Training section of the questionnaire deals with the investment behaviour of employers in connection with training and improving the skills of their employees. Finally, the last part tends to find possible explanations for the extreme values and outliers found in the quantitative regression analyses of earnings.

Data derived from the interviews did not enable us to test screening hypotheses versus human capital theory rigorously, but the results of the analysis of this qualitative data would shed light on the question “whether increase in earnings attributed to investments in human capital is due to the productivity-augmenting role of ET or whether education serves as a screening device that identifies the more able people.” In particular, the results would provide evidence on employers’ investment in their already selected employees such as financing training programmes (both general and specific training) and contributing to the payment of tuition fees of the employees who studied in an (higher) educational institution.

3.7 Methods of Analysis

In this section, the quantitative and qualitative methods of analysis are discussed. At first, the basic earnings function, which is an extended form of the Mincerian earnings function, is explained and justified. This section is followed by a discussion of the procedure whereby we examine the reliability of hypothesis testing of OLS estimates. The last part of the quantitative analysis section deals with a discussion of a proposed experimental multilevel statistical analysis.

3.7.1 Quantitative Method

In terms of the quantitative methods of analysis, two general methods can be identified to evaluate the effects of investments in human capital on earnings; Internal

Rate of Return Method¹⁰ (IRRM) and Regression Analysis (i.e., Mincerian earnings function). Both of the methods have extensively been applied by many researchers but using earnings function has several merits. An earnings function enables a researcher to isolate the effects of explanatory variables on a dependent variable. The earnings function, as Mincer (1979:13) states, permits an estimation of the effect of schooling on earnings uncontaminated by and separately from estimates of effects and volumes of post school investments and other kinds of investments. For example, by including *experience* rather than *age* variable as a more appropriate measure of post school investments it is possible to estimate the effect of (on-the-job) training on earnings more accurately, because, age is an especially poor substitute for experience in the analysis of women, whose labour market experience tends to be discontinuous. The earnings function, however, can be adapted to discontinuous work histories as well.

The association between the schooling and post schooling investment or any other independent variable is another relation that can be ascertained in connection with the application of earnings functions. For instance, it has been shown that more educated people invest more through post school investment. The cross effect of years of schooling and years of experience can account for earnings differentials attributed to such extra investment.

¹⁰ What is meant by internal rate of return is the rate that equalises the benefits of an investment with its cost. That is:
$$\sum_{t=1}^T (B_t - C_t) / (1+r)^t = 0$$

The rate of return (r) derived from the formula is regarded to be equivalent to the coefficient of years of schooling in Mincerian earnings function.

A multilevel approach is based on a regression analysis methodology. Therefore, to make a comparison between a single-level and a multilevel approach, the regression analysis technique is essential. To date, regression analysis especially Mincerian earnings function has been used extensively by many researchers in the context of human capital theory for both developed and developing countries. The superiority of the Mincerian earnings function (i.e., semi-log structure) is shown in the empirical analysis of earnings functions, (we reviewed the most relevant empirical studies in chapter 2.) We, therefore, start our consideration by using the Mincerian earnings function,¹¹ which is as follows:

$$y_i = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X_i^2 + e_i \quad (3.6)$$

where y_i is natural log earnings of higher level of human capital; β_0 , intercept, equivalent to natural log earnings of lower level of human capital; S_i , years of schooling; X_i , years of experience; and e_i , error terms. The function is based on the assumptions that (i) contribution of each year of schooling to earnings is the same across educational levels, (ii) there is no interaction between years of schooling and years of experience, and (iii) the variance of error terms is the same for all observations. However, in the belief that data used provide evidence on the rejection of the assumptions, we consider the earnings function inadequate for the purpose of the analysis of earnings differentials in the manufacturing sector of Iran. Expanded forms of the function, which include other important variables (e.g., years of schooling squared,

¹¹ The mathematical proof of the function is given in, e.g., Mincer (1974 and 1979) and Polachek and Seibert (1993).

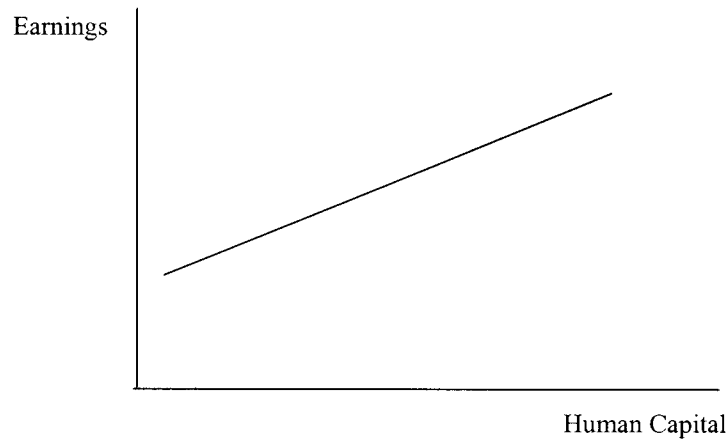
cross effect of years of schooling and years of experience, and management, which significantly influence earnings) are also used. That is, it was assumed that an extra year of schooling contributes to earnings differently across educational levels. Moreover, it was assumed that the effect of an extra year of schooling in higher education level is more than that in, e.g., secondary education partly due to vocationalisation of higher education and the fact that the capability of a student in higher education to invest in himself is more than that of a student in secondary education. These heterogeneities contribute to heterogeneity of earnings capacity. As mentioned earlier, more educated people invest more through training (experience) and employees in higher level jobs may earn differently. The basic earnings function including individual variables for the purpose of this analysis is as follows:

$$y_i = \beta_0 + \beta_1 S_i + \beta_2 S_i^2 + \beta_3 X_i + \beta_4 X_i^2 + \beta_5 S_i X_i + \beta_6 (MANG)_i + e_i \quad (3.7)$$

The function captures the non-linearity between years of schooling and earnings, the increasing gap between earnings-experience profiles of different educational levels, and earnings differentials due to job seniority. However, it ignores the effects of firms on earnings and assumes a constant variance of error term for observations (that is the points that we will focus on in the multilevel methods). The basic Mincerian earnings function (i.e., Eq. (3.6)) and many other empirical studies adopting a similar specification (including Eq. (3.7)) ignore the grouping of employees into firms, and the data are treated as a single sample of $\sum n_j$ observations. In other words, it is assumed that, for example, firm characteristics have a constant effect on all workers' earnings.

Figure 3.1 shows a linear relationship between human capital (HC) and earnings (y) under a single-level approach.

Figure 3.1: A Hypothetical Linear Relationship between Human Capital and Earnings under a Single Level of Analysis



3.7.1.1 Reliability of Hypothesis Testing

Before running any model through the multilevel methodology, we shall attempt to test the hypothesis that data used are dominated by a hierarchical structure through using intra-unit correlation. This correlation measures the proportion of the total variance, which is between firms. It also measures the correlation between different employees in the same firm. That is, when cluster effects exist the covariance between two employees in the same firm is not zero and given by:

$$Cov(u_{0j} + e_{0i^1j}, u_{0j} + e_{0i^2j}) = Cov(u_{0j}, u_{0j}) = \sigma_{u0}^2 \quad (3.8)$$

The correlation is, therefore:

$$\rho = \frac{\sigma_{u0}^2}{\sigma_{e0}^2 + \sigma_{u0}^2}$$

which is referred to as the ‘intra-firm correlation’. (An analogy is made for the case of firms based on Goldstein, 1987: 13, 1995:19.) The existence of a non-zero intra-firm correlation, resulting from the presence of more than one residual term in the model, means that traditional estimation methods, such as OLS are not appropriate. (*Ibid.*) In other words, when $\sigma_{u0}^2 \neq 0$ we would conclude that data are dominated by a hierarchical structure and, therefore, employing a multilevel approach is more desirable.

In the context of human capital analysis of earnings, the issue of clustering effect can be discussed in a variety of ways. The capability of managers, for instance, in different firms (i.e., clusters) is not necessarily the same. An able manager can lead his/her firm to a very successful position in terms of profitability, and this can affect the earnings of all employees working in the company, and not the earnings of workers of other firms. Technological aspects of production vary across firms and these variations may affect human capital accumulation and in turn earnings capacity differently. As we reviewed the literature in chapter 2, large firms pay more on average to their employees than small firms, given employees’ characteristics the same. Large firms may also employ more able and more educated people. Internal labour market in different firms is not necessarily the same. This heterogeneity would differently affect the accumulation of human capital and in turn earnings of employees across the firms. Cluster effects as such lead to creating a situation where the correlation between error terms of two

employees working in the same firm to be non zero, which indicates a hierarchical structure (i.e., Eq. (3.8))

Ignoring the hierarchical structure, as mentioned earlier, may mislead us in testing of hypotheses (depending on the extent of cluster effects). To demonstrate this statistical problem, we extend Eq. (3.8) by including some firm level variables. That is

$$y_{ij} = \beta_0 + \beta_1 S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_3 X_{ij}^2 + \beta_4 S_{ij} X_{ij} + \beta_5 (MANG)_{ij} + \beta_7 (SIZE)_j + \beta_8 (INDST)_j + \beta_9 (LOCN)_j + e_{ij} \quad (3.9)$$

$i = 1, 2, \dots, n_j$; number of employees in firm j

$j = 1, 2, \dots, m$; number of firms

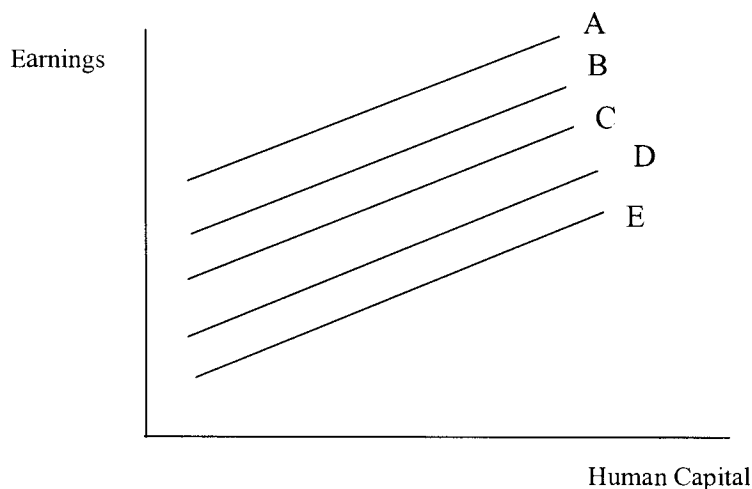
where S , X , $MANG$, $SIZE$, $INDST$, and $LOCN$ are years of schooling, years of experience, management, size of firm, industry, and geographical location, respectively, and the e_{ij} are assumed to be a random sample from $N(0, \sigma^2)$. In this model we attempt to incorporate some firm characteristics in the model by using dummy variables, though through an *ad hoc* procedure. We run the earnings function through employing both the multilevel and single-level techniques for overall observations for the sake of reliability of hypothesis testing.

Considering β_0 , β_1 , and β_2 , as random coefficients can provide evidence on the question of whether or not unreliability of hypothesis testing is the case when we use an OLS method. The results of our experiments in that respect are presented in chapter 6, section 6.4.

3.7.1.2 Multilevel Analysis

In this section, the multilevel methods of analysis employed in this study are elaborated. As a first step, the following earnings function including only employee characteristics but with firm fixed effect will be considered. That is, in this model the intercept is considered as a random coefficient varying among all companies. In other words, it is assumed that only starting wage and salary is different among the firms. Figure 3.2, in comparison with Figure 3.1, shows such relationships between human capital and earnings under a multilevel approach. As is seen, the intercepts vary among the units of the second level.

Figure 3.2: Hypothetical Constant Relationships between Human Capital and Earnings and Varying Intercept across Firms (under a Multilevel Level of Analysis)¹²



¹² To avoid complexity in this Figure and the next one we consider the varying relationship between earnings and human capital in five firms/clusters.

To describe the relationships for several firms through using an earnings function, we write, for firm j :

$$y_{ij} = \beta_{0j} + \beta_1 S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + e_{ij} \quad (3.10)$$

To make (3.10) into a two-level model, we let β_{0j} become a random variable, that is:

$$\beta_{0j} = \beta_{00} + u_j$$

Substituting β_{0j} in model (3.10) we get:

$$y_{ij} = \beta_{00} + \beta_1 S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + u_j + e_{ij} \quad (3.11)$$

where the e_{ij} again are a random variable of level 1 from $N(0, \sigma^2)$ and the u_j are a random variable of level 2 with $E(u_j) = 0$ and $Var(u_j) = \sigma_u^2$. Model (3.10) differs from Model (3.7) only by the inclusion of specific intercept parameters for each firm. One could apply, however, a single-level method to estimate a varying intercept model through including a dummy variable for each firm (i.e., in the case of this study 35 dummy variables). In that case, the number of coefficients to be estimated would be 41 rather than 7 for a model like model (3.10).

In the second step, we look at the coefficient of years of schooling as a varying parameter, which varies among all units of level 2. That is, the effect of education (i.e., years of schooling) on earnings is different among the firms. In reality, it is plausible to assume that educational qualifications are rewarded differently in different firms, as mentioned above. Again let:

$$y_{ij} = \beta_{0_0} + \beta_{1_j} S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + (u_{0_j} + e_{ij}) \quad (3.12)$$

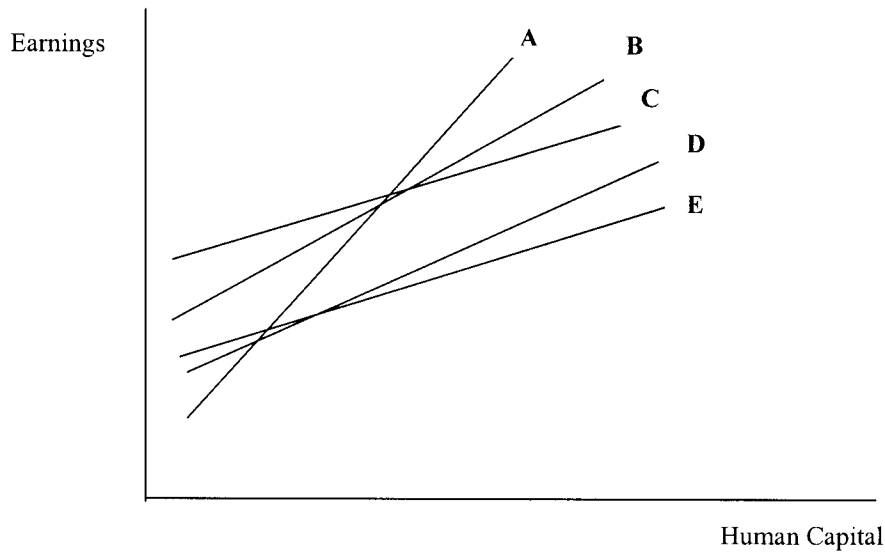
where $\beta_{1_j} = \beta_{1_0} + u_{1_j}$. Substituting β_{1_j} in the model (3.12) we get:

$$y_{ij} = \beta_{0_0} + \beta_{1_0} S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + w_{ij} \quad (3.13)$$

$$w_{ij} = u_{0_j} + u_{1_j} S_{ij} + e_{ij}$$

In (3.13) we have 3 random variables which the e_{ij} as before are the employees level error terms, and u_{0_j} and u_{1_j} are the firm's effects on the earnings differentials.

Figure 3.3: Hypothetical Varying Relationships between Earnings and Human Capital across Firms



Earnings function (3.14) considers the parameter of years of experience as a varying coefficient. In this consideration it is supposed that not only the intercepts (i.e., earnings of employees with zero year of schooling and experience) are different ($\beta_{0_j} = \beta_{0_0} + u_j$) but also the effects of both years of schooling and experience on

earnings, as Figure 3.3 shows, vary across the enterprises. That is, an additional year of schooling/experience, based on Figure 3.3, may contribute some 15 percent to increasing earnings in firm A, while the corresponding figures in firms B, C, D, and E may be 10 percent, 3 percent, 4 percent, and 2 percent, respectively. Under this situation, the earnings function is as follows:

$$y_{ij} = \beta_{00} + \beta_1 S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + w_{ij} \quad (3.14)$$

$$w_{ij} = u_{0j} + u_{1i} S_{ij} + u_{2j} X_{ij} + e_{ij}$$

As is seen from the model (3.14), the variance of w_{ij} is not the same for all observations. It varies with years of schooling and years of experience and shows that a constant variance assumed in a single level of analysis is not plausible.

In further detail, it can also be assumed that the coefficients of explanatory variable at first level (e.g., years of schooling and years of experience) vary among the units of level one. This assumption is particularly plausible when cross-section data are used. Examination of such an assumption would help to study the effects of heterogeneity in innate ability, social background, quality of schooling and experience and the like, as elaborated in chapter 2, which affect human capital accumulation and earnings capacity, on employees' earnings. Specifically, in the case of years of schooling (experience), it can be assumed that variation in the quality of schooling (experience), in part, cause the variation in the coefficient of years of schooling (experience). In fact, by imposing such assumptions, the error term at level 1 is decomposed in two or three elements. That is

$$e_{ij}^* = e_{0ij} + S_{ij} e_{1ij} + X_{ij} e_{2ij}$$

where e_{1ij} and e_{2ij} are variations in the contribution of years of schooling and years of experience to earnings, respectively, across level 1 units partly due to the quality of schooling and experience. The reduced form of earnings function would be as follows:

$$y_{ij} = \beta_{00} + \beta_1 S_{ij} + \beta_2 S_{ij}^2 + \beta_3 X_{ij} + \beta_4 X_{ij}^2 + \beta_5 S_{ij} X_{ij} + \beta_6 (MANG)_{ij} + w_{ij}^* \quad (3.15)$$

where $w_{ij}^* = u_{0j} + u_{1i} S_{ij} + u_{2j} X_{ij} + S_{ij} e_{1ij} + X_{ij} e_{2ij} + e_{0ij}$

In the above circumstances, it is assumed that the coefficients are varying among the units and companies due to randomness and chance. However, we can extend the model to a more complicated one by including firm-level explanatory variables such as the size of firms, industry, geographical location, etc. to justify, in part, the variation of parameters across the firms. In other words, in reality, it is plausible to assume that educational qualification and investment in human capital through experience are rewarded differently in different firms due to differences in management, geographical location, economic sector, size and the like. The results of such extended models are presented in chapter 6.

The focal aim of all the above mentioned experiments is to find out: (1) Is there a hierarchical structure across the units of analysis? (2) Is the testing of hypotheses based on single-level models of analysis unreliable when data used are dominated by a clustered or hierarchical structure? To what extent do employees' characteristics as well as firms' characteristics contribute to earnings?

One of the basic arguments highlighted by multilevel methodologists is that in a varying coefficient situation and when the data in fact have a hierarchical structure

applying classical regression analysis which is based on a single-level model with just one residual random term and assuming that these residuals are uncorrelated across individuals will produce unreliable results for testing of hypotheses. In such a situation, it is argued that the estimates of the regression parameters are still unbiased but inefficient. (Goldstein, 1995) The estimates of the variances are, therefore, biased, that is the expected value of the estimated variance is smaller than the true variance. In other words, we would be underestimating the true variance of the OLS estimator.¹³ This affects hypothesis testing of the regression parameters, that is we may reject the *null* hypothesis (H_0) while it is true.

To illustrate the matter of underestimating the variances and its effect on testing of hypothesis let:

$$t = \frac{\hat{\beta} - B}{S.E.(\hat{\beta})}$$

which has a t -distribution with $(n-k)$ degrees of freedom be the true observed t -value under the correct estimation of true variance of $\hat{\beta}$ (i.e., under a non-hierarchical structure). Under a hierarchical structure and, in turn, underestimating the true standard error of OLS estimator (i.e. $S.E^*(\hat{\beta})$) the t statistic will be overestimated, that is $t^* > t$

$$\text{where } t^* = \frac{\hat{\beta} - B}{S.E^*(\hat{\beta})}$$

¹³ More details are given, e.g., in: Goldstein (1995) and Maddala (1992).

since $S.E^*(\hat{\beta}) < S.E.(\hat{\beta})$.

In other words, if we ran a model using the multilevel technique, t test statistic of the coefficients would decrease compared with those of OLS. The results of the experiments presented in chapter 6 show that it is the case with our data.

3.7.2 Qualitative Methods

As illustrated in chapter 2, most empirical studies examining the relationship between education earnings and productivity have used regression techniques. Regression techniques using cross-section data cannot convincingly answer the question of “does education improve the productivity of employees or does education serve as a screening device to identify more able workers?” because in regression techniques it is not possible to control for other important factors such as innate ability, motivation, and job heterogeneity.¹⁴ In qualitative methods, it is assumed that employers are able to monitor and evaluate the performance of their employees with respect to their characteristics. Therefore, the analysis of the interviewees’ responses would provide a more appropriate and convincing answer to the research question.

Therefore, qualitative methods of analysis are employed to investigate whether increasing earnings attributed to education and training is seen by employees to be due

¹⁴ It is worth noting that some attempts were made to control for these (unmeasurable) factors through using proxies or using special sets of data. For example, using data of identical twins, Ashenfelter and Krueger (1994) were able in part to control for innate ability and social background. However, they did not include any measurements into their analysis accounting for heterogeneity in quality of education and experience, motivation, occupation, industry, and the like.

to productivity-augmenting role of education or whether education serves only as a screening device to select abler people. Data collected through interviews are used to study this aspect of human capital theory and its alternative theories such as screening and signalling hypotheses.

A number of main themes (i.e., education, experience, and training) have been identified, which correspond to the sections of chapter 7. The data has been analysed in detail and reported using indicative quotations to explore the employer behaviour in connection with investment in human capital and productivity.

The complementary data derived from the questionnaires designed for collecting quantitative data were used in order to study whether training in a specific company contributes to employees' earnings. Such data would also help to examine the question "whether more educated workers invest more than the less educated in themselves through training."

3.8 Summary and Conclusion

In this chapter, we have presented and elaborated the research design and methods of analysis. First, the main research questions and the concepts involved in this study were introduced and elaborated. In section 3.4 units of analysis, consisting of employees and firms, and the selection of samples were discussed and justified. The variables used were discussed in section 3.5. The section ended with a discussion of questionnaire design. Unlike most empirical studies, we collected data for the quantitative analysis

through questionnaires whereby employers were asked to provide data about the variables requested. This approach was more appropriate in terms of having a sufficient number of observations to conduct a two level method of analysis and enabled us to collect more accurate data of employees and firms' characteristics.

Since the debate between human capital theory and screening hypotheses is studied through conducting interviews and employing qualitative methods, the sample of interviewees and qualitative data collection were elaborated in section 3.6. We also considered the appropriateness of the qualitative methods of analysis, in comparisons with regression techniques, which are used in this study in order to examine the productivity-enhancing role of education.

Studying the advantages of the multilevel method of analysis as an alternative methodology for human capital analysis of earnings is one of the main aims of this thesis. Attempts were made, in section 3.7, to discuss and to elaborate various statistical problems that dominate the OLS estimates using data dominated by a hierarchical structure. Potential merits of multilevel methods in the context of human capital analysis of earnings were also discussed. As a result, the multilevel technique was regarded as a more efficient one for the purpose of estimation and hypothesis testing and a more powerful technique for the exploration of the determinants of earnings especially for a cross-section analysis. In particular, it helps one to study various sources of earnings variation and determinants of earnings in a more systematic, rather than an *ad hoc*, way.

Chapter 4 Structure of Economy and Education System of Iran

4.1 Introduction

The first section of this chapter presents some general information regarding geographical situation and demographic composition of Islamic Republic of Iran. The next section looks at current political structure and government of the country. Since units of analysis have been selected from the manufacturing sector of Iran's economy, attempts are made to present the current situation of the sector in comparison with whole economy in terms of value added (GDP) and the structure of employment as well as the composition of employees' qualifications. Finally, after giving some historical background of the education system of Iran, the current situation of the education system is described to shed some light on the ways of measuring education and training for the purposes of this study.

4.2 General Background

The Islamic Republic of Iran is a mountainous, high plateau country with an area of 1,648,000 kilometres. It stretches from the Caspian Sea and independent countries in the north to the Persian Gulf in the south and from Turkey and Iraq in the west to Afghanistan and Pakistan in the east. Iran thus forms strategically the land-bridge between the Middle East and Asia.

The country is rich in minerals (i.e., copper, oil, gas, and coal), and exportation of petroleum is the principal source of foreign currency.

According to the census taken in 1996, the population then numbered 60.1 million. Some 39.5 percent of the total population were under the age of 15, and 4.4 percent were aged 65 and over. The annual growth rate between 1986 and 1996 was 1.9 percent. (Plan & Budget Organisation, 1997a: 117)

Nearly 66 percent of the Iranian people are of Persian origin while 25 percent have Turkish origins, 5 percent have Kurdish origins, and 4 percent Arab origins. The official language of Iran is Persian (Farsi). Nearly 99 percent of the people of Iran are Muslims and 91 of them are followers of the Shi'ate sects, but there are also Sunni Muslims, Christians, Jews, Zoroastrians, and Baha'is. (Shamsavary, 1992: 326)

4.3 Political Structure and Government

Iran's constitutional monarchy was ended in 1979. In the same year a new constitution established an Islamic republic in which principles of Islam were to be the

foundation for social, political, and economic relations. A religious leader, who is elected by the Assembly of Experts elected by direct vote of people, called the *Wali-e faqih* oversees the operation of the government. In what follows we briefly view the structure of executive, legislative, and judiciary of Iran. ¹

4.3.1 Executive

The chief executive and head of state of Iran is a president (the highest official after the office of leadership in the country) who is popularly elected to a four-year term by the direct vote of the people. His re-election for a successive term is permissible only once.

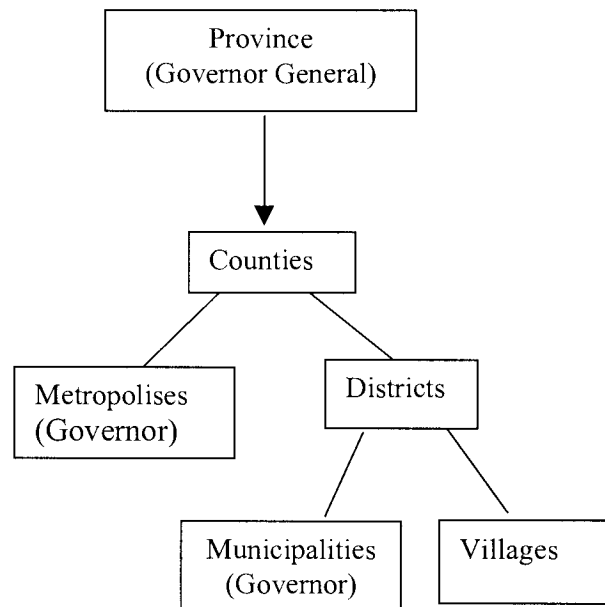
Ministers will be appointed by the President and will be presented to the Islamic Consultative Assembly for a vote of confidence. The President is the head of the Council of Ministers. He supervises the work of the ministers and takes all necessary measures to co-ordinate the decisions of the government. With the corporation of the ministers, he determines the programmes and policies of the government and implements the laws.

Each of the ministers is responsible for his duties of the President and the Assembly, but in matters approved by the Council of Ministers as a whole, he is also responsible for the actions of the others.

¹ The discussion presented in this section is based on “The Constitution of the Islamic Republic of Iran, 1990”.

Local government: Iran consists of 26 provinces, according to the 1996 census, which are divided into 252 counties and 680 districts; districts are subdivided into villages and municipalities. (Statistics Centre of Iran, 1997) Provincial and district officials are appointed by the central government; municipalities elect their own mayors. Fig. 4.1 depicts the hierarchical structure of provincial authorities.

Fig. 4.1: The Hierarchical Structure of Provincial Authorities



4.3.2 Legislative

Legislative authority in Iran is vested in a unicameral parliament called the Islamic Consultative Assembly. Its 270 members, popularly elected by direct vote of people for terms of four years, can dismiss the country's president by a no-confidence vote. Laws enacted by the Assembly must be approved by the Council of Guardians, who ensure accordance with Islamic code and the constitution. All citizens age 15 and older are entitled to vote.

4.3.3 Judiciary

The judiciary is an independent power, the protector of the rights of the individual and society, responsible for the implementation of justice and entrusted. The highest regular tribunal in Iran is the Supreme Court, the president of which is appointed by the religious leader (*Wali-e faqih*). A legal system based on Islamic law was introduced as part of the Islamic Revolution of 1979, and courts established prior to the revolution were later abolished.

4.4 Economy

In this section, we shall present data on the composition of gross domestic product (GDP) of Iran's economy. In particular, the situation of the manufacturing sector will be discussed. Then, the structure of employment in the whole economy, in general, and in the manufacturing sector, in particular, will be reviewed, using data from the last two censuses.

4.4.1 Gross Domestic Product

The gross domestic product (GDP) in 1374² (1995-96) was 15455 billion *rials*³ at constant prices (1361=100). Economic growth was 3.1 percent as compared with the previous year. The proportion of the components of GDP that is agriculture, oil,

² Iranian Year that 1374 is equivalent to March 1995- March1996.

³ Iranian money unit.

industry, and services are 24.2, 16.3, 21.3, and 38.5 percent respectively. Comparing the growth rates of the economic sectors, we observe that industry enjoyed the highest growth rate (5.7 percent) in 1374 compared with the previous year. Amongst the components of the industry sector (i.e., mining; manufacturing; electricity, gas, and water; and construction) manufacturing attributes major part of value-added of the sector to itself (i.e., 66.2 percent). It also experienced a high growth rate (5.8 percent), however, the 'electricity, gas and water' enjoyed 5.9 percent growth compared with the previous year. (Plan & Budget Organisation, 1997c: 6)

4.4.2 Employment

The number of employed people in Iran according to 1996 census was 14.6 million, which 23 percent of those employed were working in agriculture, forestry, of fishing; industry including manufacturing mining, electricity, gas, and construction employed 30.7 percent, and services employed 44.5 percent. The equivalent figures from the census 1986 are 29, 25.3 and 42.3 percent respectively, which show a significant shift from agriculture to manufacturing sector.

In terms of qualification of the employees, as Table 4.1 reveals, in 1986 only 5 percent of the employees had higher education qualification, 17 percent secondary school, 9 percent orientation school (guidance cycle), and 69 percent primary or lower level of education. During the following ten years (i.e., 1986-1996) the educational qualifications of the employed people experienced a significant change in favour of more educated people. The proportion of people with higher educational qualification

increased from 4.5 to 9.8 percent. The equivalent figures for the employed with secondary education and guidance cycle are 18 and 18.2 percent respectively.

Whereas the agriculture sector attracted minimum qualified employees, services sector has had maximum percentage of educated employees among its employees. For example, the percentage of employees with higher educational qualification in the agriculture sector was less than one percent in 1986 and 1996 whereas the corresponding figures for the services are 9 and 18.7 percent respectively. As Table 4.1 shows, the percentage of the employed people with higher education qualifications has increased substantially (more than twice) during the period.

Table 4.1: Employed Population by Economic Sector and Educational Level 1986, 1996

(Percent)

Economic Sector	Year	As % of Total*	Educational Level				
			Sum	Primary & Less**	Guidance Cycle	Secondary	Tertiary
Agriculture	1986 ¹	29.1	100	93.6	3.8	2.0	0.2
	1996 ²	23.0	100	88.9	11.2	4.1	0.6
Industry	1986	25.3	100	79.8	8.6	9.3	1.7
	1996	30.7	100	62.9	21.3	13.2	3.8
Manufacturing	1986	13.2	100	75.3	10.4	11.9	1.7
	1996	17.5	100	58.0	23.3	15.1	3.6
Services	1986	42.3	100	46.4	13.0	30.6	9.0
	1996	44.5	100	32.6	19.9	28.5	18.7
Not Classified	1986	3.3	100	59.2	9.9	20.2	6.4
	1996	1.8	100	54.3	15.5	19.5	10.7
Total	1986	100	100	69.0	9.1	16.5	4.5
	1996	100	100	54.7	18.2	18.0	9.8

Note: * Total number of employed workers were 11.04 and 14.6 million in 1986 and 1996, respectively.

** The figures consist of the proportions of the employed with primary school qualification, adult-literacy programme, and non-formal qualification, and the illiterate.

Source: 1. Statistics Centre of Iran (1988: 129)
2. Statistics Centre of Iran (1997: 145)

The industry sector also has enjoyed an increasing proportion of more educated people. For example, the percentage of the employed with guidance cycle qualification increased from 8.6 percent to 21.3 percent. The corresponding figures for employees with higher education are 1.7 percent and 3.8 percent. Amongst the components of industry sector, 52 percent of the employees of the sector were working in the manufacturing which the proportions of employees with higher education, secondary, orientation, and primary or less education level in 1986 were 2, 12, 10, and 75.3 percent respectively. The equivalent statistics for 1996 are 3.6, 15.1, 23.3, and 59. As in other economic sectors, manufacturing sector also attracted more educated people.

4.4.3 Manufacturing Sector

As discussed in the previous section, the manufacturing sector enjoyed a relatively high growth rate of employment and value added. In this section, the structure of this sector is elaborated in further detail.

In 1986, 13.2 percent of those employed were working in the manufacturing sector. The equivalent figure for 1996 is 17.5 (i.e., on average, a growth rate of 5.7 percent per year) which shows a considerable increase in the number of employed population in the sector. The proportion of the employed persons with different educational qualifications indicates that the structure of the qualifications of the employees has dramatically changed in favour of higher education. As Table 4.1 shows, while the proportion of employees holding “primary or less” educational qualifications decreased from 75.3 to 59 percent during 1986-1996, the proportion of employees with guidance cycle, secondary and tertiary education increased from 10.4, 11.9 and 1.7

percent to 23.3, 15.1 and 3.6 percent, respectively. During the period, the number of employed people with guidance cycle and tertiary education enjoyed the highest growth rate.

The composition of educational qualifications of the employed persons in the sub-sectors of manufacturing sector is presented in Table 4.2. As is seen, the composition of educational qualifications across the sub-sectors is not the same. The proportion of employees with primary education in the sub-sector of “Non-Metallic Mineral Products” was 83.2 percent in 1986 whereas the equivalent figure for “Paper, Cardboard, and Publishing” is 52 percent, which is the lowest figure among the sub-sectors and indicates that the proportion of employees who hold higher educational qualifications are reasonably high, in comparison with the former sub-sector. The proportion of employees with tertiary education was the lowest for the sub-sector of “Textile, Clothing and Leather”, as expected, and highest for the sub-sector of “Chemicals, Petroleum, Coal, Rubber and Plastic” in 1986. Figures about the composition of employees with tertiary education show that the sub-sectors of “Chemicals, Petroleum, Coal, Rubber and Plastic”, “Basic Metal Industries” and “Paper, Cardboard, and Publishing” could attract more highly educated individuals. A number of explanations can be addressed with regard to this phenomenon such as technological heterogeneity, size of establishments/firms, and economic sector (i.e., public or private). It seems that the size of firms is one of the main reasons that can explain, in part, heterogeneity in educational qualifications across the sub-sectors. This is, it is more likely to be the case that larger firms attract more highly educated workers.

Table 4.3 shows the number of firms/establishments in the sub-sectors of the manufacturing sector and reveals that most units of the manufacturing sector (i.e., 96.4

percent) have employed 0-9 workers. However, this pattern is not the same among the components of the manufacturing sector. As is seen, the proportion of firms with larger size in sub-sectors such as “Paper, Cardboard, Publishing & publishing”, “Chemicals, Petroleum, Coal, Rubber and Plastic”, “Non-Metalic Mineral Products”, and “Basic Metal Industries” is higher than that in other sub-sectors. As presented above, the proportion of employees with higher education levels is higher in the former group than that in the latter one. Therefore, it is reasonable to infer that more educated workers are employed in larger firms. Data collected for this study presented in chapter 5 support this argument.

Table 4.2: Employed Population in Manufacturing Sector by Educational Level, 1986

(Percent)

Sub-Sector	Sum	Primary or Less*	Guidance Cycle	Secondary	Tertiary	Not Reported**
Food, Beverages & Tobacco	100	80.0	8.8	9.4	1.2	0.63
Textile, Clothing & Leather	100	82.0	9.1	7.6	0.6	0.83
Wood & Wood Products	100	74.5	12.1	11.8	0.9	0.63
Paper, Cardboard, Publishing &	100	51.9	13.5	29.7	4.1	0.83
Chemical, Petroleum, Coal, &	100	55.9	10.6	26.5	6.3	0.73
Non-Metalic Mineral Products	100	83.2	6.7	8.2	1.2	0.63
Basic Metal Industries	100	64.8	9.0	20.2	5.4	0.61
Machinery, Equipment &	100	64.1	15.6	17.1	2.4	0.73
Other Industries	100	53.7	16.3	25.3	3.7	1.03
Total	100	75.3	10.4	11.9	1.7	0.73

Note: * The figures consist of the proportions of the employed with primary school qualification, adult-literacy programme, and non-formal qualification, and the illiterate.

** Educational qualifications were not reported.

Source: Statistics Centre of Iran (1988: 129)

Table 4.3: Manufacturing Establishments by Number of Workers (1990)
(Percent)

Sub-Sector	Total			0-9	10-99	100-999	≥1000
	Number	As % of Total	%				
Food, Beverages & Tobacco	60939	20.5	100	97.5	2.2	0.2	0.0
Textile, Clothing & Leather	104611	35.2	100	97.8	2.0	0.1	0.0
Wood & Wood Products	33823	11.4	100	98.9	1.0	0.1	0.0
Paper, Cardboard, Publishing &	3099	1.0	100	85.2	14.0	0.7	0.1
Chemical, Petroleum, Coal, &	3919	1.3	100	72.1	25.2	2.3	0.3
Non-Metalic Mineral Products	19476	6.5	100	86.3	13.1	0.5	0.1
Basic Metal Industries	1796	0.6	100	84.2	14.	1.2	0.6
Machinery, Equipment &	66065	22.2	100	97.0	2.8	0.3	0.0
Other Industries	3641	1.2	100	97.1	2.9	0.1	0.0
Total	297369	100.0	100	96.4	3.3	0.3	0.0

Source: Statistics Centre of Iran (1995:109)

4.5 Education System

In what follows, in the first place, historical information about education system of Iran is presented. Then, the current structure of formal education is explained in terms of enrolment ratios, number of students, and number of graduates. This section is followed by a discussion of adult and non-normal education. Finally, the administrative and supervisory structure of the education system is briefly reviewed.

4.5.1 Historical Background

Prior to the Arab conquest and the propagation of Islam in 642 AD, the Zoroastrian religion dominated the area emphasising three duties which parents and society were supposed to teach the children: pious thoughts, good deeds, and kindly

speech. Physical education was also taught to ensure a sound body. After 642 AD and the country's conversion to Islam, the concept of knowledge enjoyed an important place. The Qur'an speaks repeatedly of its importance: 'alm (knowledge) and its derivations "make up around one percent of its vocabulary." (Rosenthal, 1970; quoted in: Menashri, 1992: 15) Islamic tradition (*sunnah*) makes the search for knowledge a duty of all Muslim men and women throughout their life, and in any place. (Motahhari, 1961: 108-109) Even greater importance is attached to knowledge in the Shi'ate sects, so one of the main qualifications required for the source of religious imitation is to be the 'most learned' cleric. Moreover, Islamic tradition linked knowledge and status. According to Shi'ate tradition, as al-Isfahani puts it, "knowledge lifts the lowly person to the heights. Ignorance keeps the youth of noble birth immobile." (Re-quoted in Menashri, 1992: 15) Islam did not, however, encourage the search for knowledge merely for the sake of status. Status was expected to come to those who engaged in searching knowledge. In other words, various aspects of human life (i.e., the physical, intellectual, social, emotional, moral) receive attention in Moslem scriptures. However, the main focus is on the development of human character, of moral behaviour, and of one's relationship to God. All other aspects are expected to be necessary conditions to interact in a way that contributes to the person's character and moral growth. (Obeid, 1994: 3021)

Due to the above situation of knowledge in Islam, the mosques became centres of learning. The Qur'anic and Islamic schools emerged with a curriculum of scripture, logic, Arabic, and grammar. These schools, that is *Maktabs* (i.e. elementary schools) and *Madresahs* (i.e. higher schools), especially after the Muslim conquest, dominated for centuries. Learning and education centres expanded to hospitals (Menashri, 1992:16) as well as some higher education establishments such as Academy of Jundi-Shapur in

South West of Iran, and Nizamiyyahs in some Iranian cities. (Shamsavary, 1992: 326)

These centres remained centres of scientific inquiry, training and education. Teaching religion remained central to Muslim scholars, but instruction for the life of this world had its place too. (Menashri, 1992: 16)

Notwithstanding these developments, devastating wars and invasions led to long periods of political and economic instability and thus to the downfall of many excellent centres of higher learning. (Shamsavary, 1992: 326) A state education system was introduced in late 19th century based on the centralised French model and, by the early 1980s, only the *Maktabs* and *Madresahes* could survive. Since 1980s onwards, early stages of religious literacy, particularly Quranic course, which had been provided by *Maktabs*, have been taught in schools and Literacy Movement as a part of curriculum.

Modern elementary and secondary schools were opened in Iran only in the 1870's. Public elementary schools, however, were opened from 1890 onward, and all in all, in 1918/9 that is more than a century after the first contacts with western education were made by sending Iranian students to European universities in 1811, there were no more than several dozen new elementary schools (with a total of 24033 pupils) and few secondary schools (with 2392 students). (Menashri, 1992: 60) The curriculum and the pedagogical approach differed from one school to another according to the educational philosophy of founders. It was, as Sadiq (himself a student at such a school) noted, a period of "experimentations with a new education." (Quoted in Menashri, 1992: 61) However, they all were completely different from the traditional system and the majority of teachers and headmasters were graduates of foreign schools or of Dar al-

Fonun⁴ and were not dependent on the religious establishment. In line with the tendency already prevalent before the constitutional revolution during 1906-1921, advocates of educational reform attached overriding importance to elementary education. The early stage of education, more than the later ones, was a prerequisite for a durable constitutional regime and an essential condition for building a modern nation-state, for social and economic progress, and, of course, for expanding and improving higher education. (*Ibid.*: 77)

The history of higher education in Iran dates back 2000 years when famous educational institutions such as the Academy of Jundi-Shapur became intellectual sanctuaries for the learned men. Iran's recent history of higher education, however, goes back to the mid-nineteenth century when a renewed process of radicalism and reform engulfed the whole country which led to establishing Dar al-Fonun in the mid nineteenth century with the specific aim of solving Iran's urgent need for trained labour force. (Shamsavary, 1992: 326)

A systematic approach to higher education had to wait until the 1930, when the Education Act of 1934 established the university of Tehran, which brought all small and separate colleges and schools of higher education under a single administration. A significant growth in scale and diversity of higher education in response to the changes of modernisation and economic development has been experienced since the 1940s. (*Ibid.*)

⁴ Dar al-Fonun was the first new institution of higher learning in Iran established on 28 December 1851. Its object was to make western technology available to Iranians. It was the first educational institution in modern Iran to be set up by the political, rather than the religious, establishment, and the first to teach western sciences. (Menashri, 1992: 53)

New attempts to improve and expand education were made in the 1950s. Iran participated in the UNESCO/UNDP world literacy programme and a World Conference of Ministers of Education was convened in Tehran in 1965. An international institute for adult literacy was established in the Iranian capital in 1968, and literacy rates increased to 55 percent for males and 30 percent for females. However, millions of persons could still not read and write and school enrolment rates were low, particularly in rural areas and among women. (Aziz-zadeh, 1994: 3007)

Following the Islamic Revolution of 1979, the content of education was changed so that all teaching and curriculum should not be against Islamic principles. Efforts were also made to teach the Holy Qur'an, the traditions of Islam, and the Constitution of the Islamic Republic. Since education and development of people's knowledge have been one of the key aims and priorities of the Islamic revolution, efforts were devoted to expand educational facilities so during the first-five-year development plan of Iran the education capacities expanded extensively in both public sector, by increasing the proportion of education in government budget⁵ and establishing new educational facilities for Adult Literacy, and private sector, by establishing private schools and Islamic Open University. The education structure of Iran, following the above developments, gives all students a reasonable chance to study according to their attitudes and aptitudes.

⁵ The proportion of education of government budget during the plan period has improved considerably and varied between 25% and 33%. Public educational expenditure has experienced an average growth of 38 percent per year during 1989-1995. (Plan & Budget Organisation, 1997c: 39-41)

4.5.2 The Structure of Formal Education System

So far, we have presented historical background information about education in Iran. In this section we elaborate the current status of educational system in more detail. In the first section, the situation of primary and secondary education is viewed. The section is followed by a discussion of higher education status.

i) Primary and Secondary Education

There exists one year pre-primary education for five-year-old children. However, Primary Education is the first stage of formal education. It begins at the age of six and lasts five years. Then follows a guidance or orientation course lasting three years. These eight years of education are assumed to be general education.

Secondary education comprises four-years of formal schooling for youths. After passing the requirements of the guidance/orientation course, pupils can continue their studies in one of the many areas of the secondary level, which is divided into two main branches: technical-vocational and academic. Technical-vocational is an alternative for those students who have completed the orientation course and wish to continue their education in technical and vocational fields.⁶

After successfully passing final examination at the end of each academic year pupils can pursue their education at the next stage. In other words, promotion from one grade to the next is mainly based on the results of an end-of-year internal examination.

⁶ Before restructuring the pre-university education system in 1971/2, each of elementary and secondary schools lasted 6 years and there was not any orientation course or intermediary schools. (Menashri, 1992: 177)

In each subject, children's work is mainly scored on a 0 to 20 scale. An average score across subjects of at least 10 is required for promotion. Those falling below 10 must repeat the year.

At the end of primary education, a regional test is administered and a certificate is awarded to the successful candidates. A provincial test is administered at the end of the lower-secondary level of education (i.e. orientation) and again a certificate is awarded to successful students. Admission to secondary education requires certain levels of performance in each specific subject area. The test at the end of secondary education is administered at the national level, and the successful candidates are awarded a diploma certificate.

As Table 4.4 reveals, during 1985-1994 enrolment ratios experienced a substantial improvement. In 1985 the enrolment ratio of primary level was 96 percent and increased to 99 percent in 1995. The corresponding figures for secondary level are 44 percent and 69 percent, respectively, which show that during the period further education has been promoted substantially. However, the enrolment ratios for pre-primary education remained the same.

Table 4.4: Gross Enrolment ratios by educational levels

(percent)

	Pre-primary	Primary	Secondary	Tertiary
1985	7	96	44	4.1
1995	7	99	69	14.8

Source: UNESCO (1997): 3-47 and 3-48.

During 1989-1996 period, the number of students in the general education level experienced a substantial growth. The number of primary school students rose from 8.9 million in 1989 to 9.2 million in 1996 (about one percent growth per year). The number of guidance cycle students increased from 3.1 million in 1989 to 5.3 million in 1996 (about 8 percent growth per year). In the secondary level, the number of students reached 3.8 million in 1996, up from 1.7 million in 1989 (about 12 percent growth per year). (Plan & Budget Organisation, 1997b: 96)

ii) Higher Education

After secondary school graduation, the students who wish to continue their higher education take part in an annual multiple-choice nation-wide examination for entry to universities, teacher-training centres, and colleges of technology. Admission to all these institutions is based on the completion of secondary schooling and the results of the examination.

A university has one or more faculties which offer courses usually lasting two years for upper Diploma, four years for Bachelor of Science, six years for Master of Science or Arts and medical, dental and veterinary courses, and later on Doctor of Philosophy. (Aziz-zadeh, 1994: 3008) Higher education is categorised as medical education, sciences, technical education and engineering, social sciences and humanities, and agricultural and veterinary.

In 1985 the enrolment ratio at tertiary level was very low (e.g., 4.1 percent). The figure, however, has experienced considerable increase during 1985-1995. That is, it increased from 4.1 percent in 1985 to 14.8 percent in 1995. (Table 4.4) In terms of number of graduates, higher education also experienced a substantial improvement

during recent years. As Table 4.5 shows, during the 1989-1996 period, the number of graduates increased from 51 thousand in 1989 to 161 thousand in 1996 (an average growth of 18 percent per year). The figures for the number of graduates of non-public higher education institutions are even more impressive. That is, during the period the number of graduates experienced some 23 percent growth per year. It should be noted that the substantial growth in the number of graduates is partly as a result of the establishment and development of Islamic Azad University in 1980s that has branches in different cities. Students who study at the university also have to pay their own tuition fees.⁷ The remarkable increase in the number of the university's students could be explained in the way that the students invest in themselves through education for their future benefits.⁸

Table 4.5: Number of Graduates of Higher Education Institutions between 1989-96

(thousand)

Graduates	1989	1990	1991	1992	1993	1994	1995	1996*	Growth %
Public **	33	37	43	52	59	64	74	85	15
Non-Public	18	25	32	42	50	59	66	75	23
Total	51	52	75	95	109	123	140	161	18

Notes: * Estimation

**The teacher training centres are excluded.

Source: Plan & Budget Organisation (1997b: 102).

⁷ In some cases the parents of the students and/or their employers, in the case where the student is employed, may contribute to pay the tuition fees.

⁸ We shall elaborate this issue in chapter 5 and 6.

Table 4.6: Number of students in universities and higher education institutions

(thousand)

	Academic Year					Percentage change
	1990-91	1991-92	1992-93	1993-94	1994-95	
Islamic Azad University	176	223	303	368*	431*	25.1
Public Universities & ...	312	344	376	437	479	11.3
Total	488	567	679	805	910	16.9

Note: * Excludes students who discontinued their studying.

Source: Central Bank of I.R. of Iran (1995): 116-117.

4.5.3 Adult and Non formal Education

Although, adult education dates back to 1936 (Menashri, 1992: 96), in the 1980's great interest and effort were devoted to non-formal education, particularly to literacy work to eradicate illiteracy. The literacy programme provided by the Literacy Movement has two parts: an initial stage of 180 hours followed by a second stage of 288 hours. The primary stage is equivalent to two years of schooling at the primary level and the second stage to four years of schooling at the primary level. (Ministry of Education, 1990: 33) The programme is offered in special institutes or in the work place, leading to literacy of skill certificates. (Plan & Budget Organisation, 1997b: 96) Some 10 million illiterates participated in literacy classes in the period 1980-90. About 65% of these classes were allocated to women and more than 60 percent of them were held in rural areas. (Aziz-zadeh, 1994: 3009)

4.5.4 Administrative and Supervisory Structure of Education System

The organisation of the modern educational system in Iran was closely modelled on that of France and is, therefore, highly centralised. The Ministry of Education

through its central bureaucracy and regional representatives administers and finances the schools at primary and secondary levels of education. The Higher Council of Education, as an autonomous and legislative body, approves all policies and regulations related to education at pre-university level. Efforts are being made to establish regional education councils and to develop their authority in allocating funds and a considerable range of administrative duties. (Aziz-zadeh, 1994: 3009)

In the first and second five-year development plans (1989-1998), the government has also indicated its intention to expand non-profit schools, which are financed by parents.

The administration and management of educational activities in higher education in public sector vested in the Ministries of Culture and Higher Education, and Health and Medical Education. The latter ministry is responsible for medical higher education and the former one for non-medical. Islamic Open University, which was established in order to make higher education accessible to all enthusiastic and willing individuals is managed and administrated by the Council of the University. Higher Council for Cultural Revolution also approves policies mainly related to higher education. (*Ibid.*)

4.6 Summary and Conclusion

In this chapter an attempt was made to present general information on the political structure and government, the structure of economy, in terms of GDP and employment, and the structure of education, in terms of enrolment ratios, number of students, and administrative and supervisory structure of education system in Iran. In particular, data on the situation of the manufacturing sector was presented in further detail, which such

information is useful to be compared with the characteristics of sector derived from the sample of observations collected for this study. Such a comparison will be made in chapter 5.

In reviewing the current structure of education, we found that the number of students, especially those studying at higher education institutions and universities, increased dramatically during the last decade. In chapter 5 and 6, through conducting a human capital analysis of earnings, we shall explain such a phenomenon.

Chapter 5 Education, Experience, and Earnings: Empirical Analysis

5.1 Introduction

In the first part of this chapter the sample of observations, both firms and employees, is described. This section is followed by a description of the characteristics of firms and employees. For that purpose, the characteristics of firms and employees are elaborated in further detail through presenting their mean and standard deviation. Earnings-experience and earnings-age profiles are also employed to establish the relationship between human capital variables and earnings through plotting diagrams. This section is followed by a presentation of first part of our regression analysis employing standard and classic ordinary least squares (OLS). By applying the OLS method, we attempt to evaluate and then discuss the effects of individual and some firm characteristics that account for earnings differentials. A comparison is made between the results of the OLS analysis from this study with those of other empirical studies.

5.2 Some Descriptive Evidence

One of the main purposes of this study is to investigate the questions: Do education and experience contribute to increasing earnings of employees in the manufacturing sector of Iran's Economy? If so, to what extent? After discussing the characteristics of data collected, in the following sections attempts are made to answer the questions through using the simple tabulation method and earnings-experience/age profiles.

5.2.1 The Sample of Firms and Employees

To investigate the relationship between human capital investments (education and experience) and earnings, a sample of firms from the manufacturing sector have been selected as a case study.¹ The basic units of analysis are full-time male employees working at the selected firms. To collect appropriate data in that regard two questionnaires (one consists of the characteristics of employees and the other consists of the characteristics of employers/firms), elaborated in chapter 3, have been designed and distributed among 65 companies located in different geographical areas of Iran. The questionnaires were distributed among the firms by the researcher and two assistants in the cases where the firms have had a representative (office) in Tehran, and by mail for the cases where there was not a representative. As Table 5.1 shows, data of both

¹ The process of sample selection was discussed in chapter 3.

individuals and firms' characteristics from 42 companies (i.e., 65 percent rate of response) have been collected. Of these, 35 companies provided appropriate data on which this analysis is based. Therefore, seven firms' data were excluded because data given concerning the characteristics of these firms were not complete and appropriate for final analysis. For example, two companies provided data of earnings only for the last month of the year. Usually employees are paid more in that month due to New Year allowance and the like. Another firm did not provide data concerning the educational qualifications of its employees.

Main economic activities of the firms can be classified into food and beverage, textiles and clothing, paper and cardboard, chemical and medical, non-metallic mineral, and machinery and fabricated metal products.

Table 5.1: The Sample of Firms and Rate of Response

	Number of Companies	Percentage
Distributed Questionnaires	65	100
Collected/Received Questionnaires	42	65
Selected for final Analysis	35	54

At the individual level of analysis we have 15755 observations (full time male employees) that the average number of observations (employees) within each company is 450. However, the number of employees varies from 19 to 2162 among the 35 companies. As Table 5.2 reveals, some 10 firms have employed fewer than 100

(between 1-99) workers each, 18 employed between 100 and 999 people, and 7 had 1000 or more employees. In other words, 550 employees have been working in 10 firms, 4965 persons were employed in 18 enterprises and 10240 individuals in 7 firms.

Table 5.2: The sample of Firms by number of employees

	1-99	100-999	1000 and over	Total
Sample of Firms	10	18	7	35
Number of Employees	550	4965	10240	15755
As % of Total	3.5	31.5	65.0	100

Table 5.3: The Composition of Firms and Employees by Geographical Location

	Small Cities		Large Cities		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Firms	8	22.86	27	77.14	35	100
Employees	4501	28.57	11254	71.43	15755	100
Average YS*	5.8		6.3		6.1	
Average YX*	10.5		13.9		12.9	

Note: * YS and YX stand for years of schooling and years of experience.

In terms of geographical location, 8 firms of 35 (i.e. some 23 percent) are located in small cities.² The rest are located in large cities. Table 5.3 presents the composition

²A large/big city is defined a city that has one million or more population. A city with less than one million population is considered as a small city.

of firms by geographical location. It is seen that employees working at firms located in large cities have a higher average of years of schooling and years of experience.

5.2.2 Characteristics of Employees

Average years of schooling of all individuals across all firms is 6.1 years. The corresponding standard deviation for years of schooling across all companies is 4.1 years. Looking at years of schooling in different educational levels (i.e., primary, guidance cycle, secondary, and tertiary), we can observe that average years in each educational level are 2.9, 6.7, 11.4, and 15.7, respectively. The corresponding figures for standard deviation are 1.9, 0.9, 1.0, and 1.2, respectively. The percentage of employees with primary education is about 50 per cent. Some 25 percent of employees have guidance cycle education, 22.3 per cent secondary education and 3.3 per cent have tertiary education. It is worthwhile noting that the equivalent figures for manufacturing sector derived from general housing and population census 1996 are 59.0, 23.3, 15.1, and 3.6 percent, respectively. (More details are provided in chapter 4.)

Table 5.5 shows the distribution of employees' years of experience by level of education. The overall mean years of experience is 12.9. However, the corresponding figure for employees who hold the qualification of education level 1 is 15, which is higher than the mean of other educational levels. It shows that more educated employees have fewer years of experience. In terms of years of experience within and outside of current firm (internal and external experience), the observations show

different patterns. While employees with educational levels 1, 2 and 3 have mainly worked for their current firm (i.e., about 87 per cent of their working life), employees with tertiary education have only worked some 50 per cent of their working experience for their current employers.

Table 5.4: Mean Years of Schooling by Educational Levels

Educational Level	Mean	Std. Dev.	As % of Total*	As % of Total**
1	2.9	1.9	49.5	58.0
2	6.7	.9	24.9	23.3
3	11.4	1.0	22.3	15.1
4	15.7	1.2	3.3	3.6
Total	6.1	4.1	100	100

Note: Educational levels 1, 2, 3, and 4 are equivalent to 0-5, 6-8, 9-12, and 13 or over years of schooling.

* The percentage of employees in each educational level.

** Figures presented in the column are derived from Table 4.1 and indicate the composition of educational qualifications in the manufacturing sector.

Table 5.5: Distribution of Employees' Years of Experience by Educational levels

Educational Level	Experience Inside Current Firm	Other Experience	Total	
			Mean	As % of Total
1	12.9	2.1	15.0	49.5
2	10.4	0.9	11.3	24.9
3	8.9	1.6	10.4	22.3
4	5.4	5.0	10.4	3.3
Total	11.2	1.8	12.9	100

Table 5.6 shows the average hourly earnings of the employees by educational levels and years of experience and reveals a positive relationship between human capital

variables (education and experience) and earnings. That is, more educated workers receive much more earnings than less educated ones, and employees with more years of experience compared with less experienced workers have also received more earnings. For example, an employee with educational level 1 and with no experience earned 1177 *rials* per hour in 1374 (i.e., 1995-96). The corresponding figures for employees with educational levels 2 and 3 are 1497 and 2682, respectively, holding experience years constant (i.e., $X=0$). The differences reveal that secondary education could contribute some 320 *rials* (27 percent) to increasing hourly earnings. The corresponding figure for higher education is even higher. That is, employees who have tertiary education compared with those who have education level 1, would earn 1505 *rials* more (i.e., 127 percent), holding years of experience constant (e.g., $X=0$).

Furthermore, holding years of schooling constant, we can observe the same relationship between investment in human capital through on-the-job training (i.e., post-school investment) and hourly earnings. For example, an employee with 0 years of experience on average earns 1177 per hour while an employee with 20 years of experience, given the same schooling level (i.e., education level 1), earns 1908 *rials*. The difference is about 62 percent for 20 years of experience (2.4 percent per year). In other words, it might be said that an extra year of experience could contribute some 2.4 percent to increasing hourly earnings. The corresponding figures for all observations and for employees with tertiary educational qualification are 1.5 and 2.7, respectively. The empirical findings provide evidence on the fact that investment in human capital after completion of schooling (i.e. through experience) is also productive and creates

variation in the earnings of individuals. This variation may be across age or years of experience; age variation of earnings is referred to as earnings-age profile, and experience variation to earnings-experience profile.

Table 5.6: Hourly Earnings by Educational Levels and Years of Experience

Years of experience	Primary Education	Secondary Education	Tertiary Education	Total
0	1177	1497	2682	1493
2	1275	1728	3024	1534
4	1330	1483	2606	1415
6	1452	1638	2777	1550
8	1436	1753	2866	1600
10	1538	1933	2743	1675
12	1676	2424	3366	1946
14	1621	2334	3109	1826
16	1752	2294	2936	1862
18	1844	2429	4663	2003
20	1908	2304	4597	2021
22	2081	2473	4370	2221
24	2118	2633	5368	2262
26	2017	2379	5249	2135
28	2151	2724	4521	2285
30	1846	2270	5591	1974
Total	1671	2009	3354	1802

5.2.3 Earnings-Experience and Earnings-Age Profiles

So far some descriptive figures of the relationship between earnings and the employee characteristics were presented. The figures, however, do not show the systematic variation of earnings with human capital variables. Earnings-experience profiles depict such a relationship. Figure 5.1 demonstrates that earnings increases with years of experience. It also shows that such a relation exists for groups of employees

with different educational background. However, the steepness of earnings-experience profiles for each educational group is not the same. More educated employees have a steeper earnings-experience profile than the less educated. In other words, the gap between the profiles increases with years of experience. This empirical evidence can explain partly the idea that more educated people invest more through experience and training.

Earnings-Age Profiles, Figure 5.2, also show the same pattern in connection with the relationship between education and earnings. Earnings are higher at higher levels of education, and increases with age through the working life. However, the rate of increase in hourly earnings diminishes with age. The differences among educational levels are also systematic. The absolute and relative growth rate of earnings increases with educational level. In other words, while educational level increases, the effect of an extra year of schooling on increasing earnings is incremental. The profile of earnings for employees who hold higher educational qualification indicates that the working life of more educated workers starts some 4 years after that of the less educated. After quite a short period, earnings of employees with higher education overtake those of the less educated.

Comparing the profiles of earnings-experience with those of earnings-age shows that earnings-age profiles are steeper than earnings-experience profiles. It can be implied that years of experience cannot capture the whole earnings differentials during working life. In other words, there are some other factors that affect employees' earnings such as the quality of education, off-school training, managerial responsibility,

place of employment, etc. that need to be included in the analysis. For example, employees who had managerial responsibilities earned almost twice as much other employees. (Table 5.7) However, on average, managers are the individuals who are more educated and experienced. The average years of schooling of an employee with a managerial job is 10, in comparison with 5.7 years of a non-manager employee. The equivalent figures for years of experience are 17 and 12.5, respectively. By using a simple tabulation, however, it is not possible to evaluate the effect of such factors on earnings.

Table 5.7: The composition of years of schooling and years of experience of employees by managerial responsibilities

	Manager	Non-Manager	Total
Years of Schooling	10	5.7	6.1
Years of Experience	17	12.5	12.9
Hourly Earnings	3364	1638	1801

5.2.4 Summary

Overall, the above mentioned evidence as well as the earnings-experience profiles reveals a positive relationship between human capital characteristics and earnings. However, earnings differentials are affected by different factors and we cannot attribute the whole earnings differentials only to years of schooling and experience and/or managerial responsibilities. For instance, as presented above, managers are paid more, in comparison with non-manager employees. One reason is that the managers are the

more educated and the more experienced personnel, as demonstrated above. Larger firms or firms located in big cities may pay more to their employees.

On the other hand, by using this device (that is a simple tabulation and earnings-experience profiles) we cannot include such factors and, in turn, evaluate the real effect of education (years of schooling) and experience on earnings. Therefore, we have to employ a more powerful device of data reduction (i.e., a regression analysis) that enables us to evaluate the effect of human capital investments on earnings after isolating the effects of other influencing factors more accurately. Next section deals with the regression analysis.

Table 5.8: Mean Hourly Earnings by Level of Education and Age
(Rials)

Age	Primary Education	Secondary Education	Tertiary Education	Total
18	1270	802		1203
20	1283	1140		1239
22	1209	1197	768	1202
24	1296	1646	1812	1422
26	1314	1529	2158	1397
28	1377	1550	2307	1469
30	1444	1691	2537	1556
32	1530	1763	2637	1630
34	1701	1997	3062	1828
36	1705	2313	3366	1947
38	1753	2312	3289	1921
40	1778	2234	3647	1951
42	1795	2454	3569	1986
44	1865	2359	4364	2066
46	1833	2292	3713	1970
48	1913	2648	4351	2094
50	1803	2395	5546	2005
52	1815	2649	3288	1899
54	1921	2477	4898	2046
56	1808	2172		1831
58	1840	2171	5394	1959
60	1667	2646	7669	1754
62	1571	2121	6575	1686
64	1606	1531	6213	1643
Total	1670	2009	3354	1801

Figure 5.1: Earnings-Experience Profiles

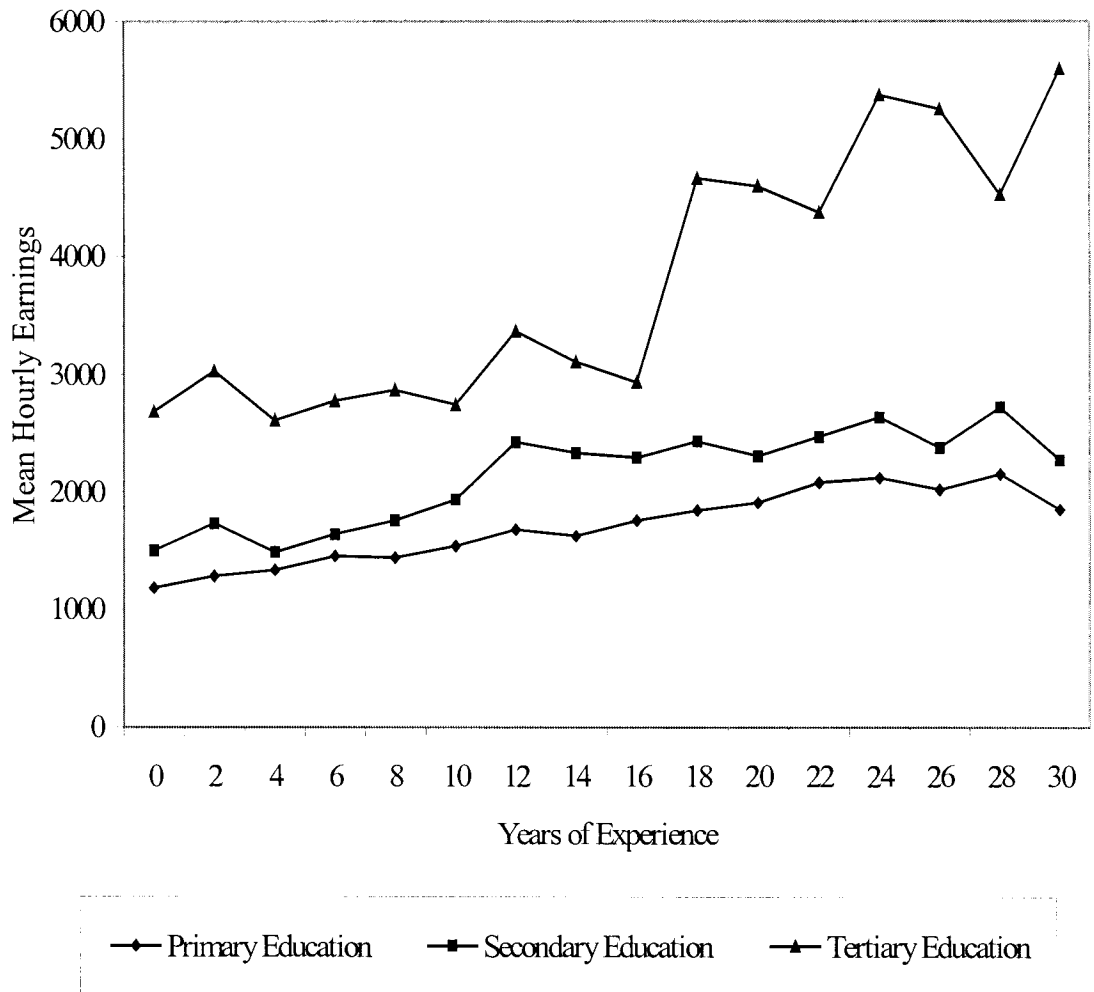
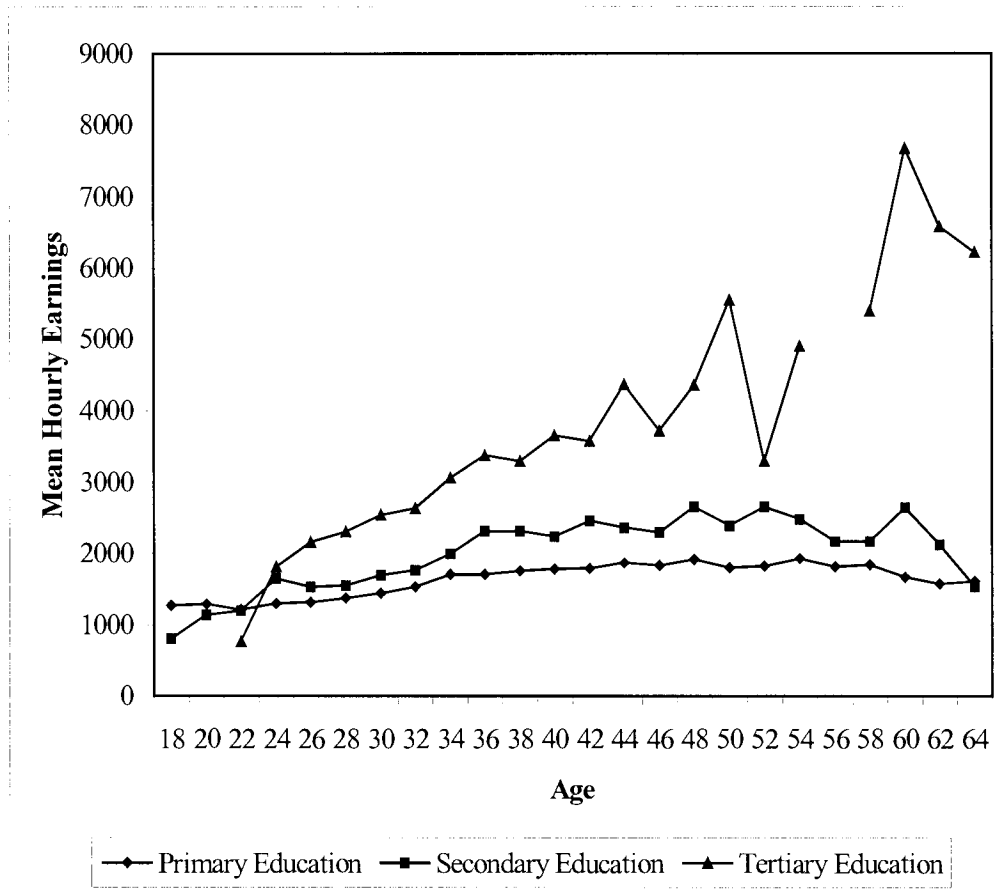


Figure 5.2: Earnings-Age Profiles



5.3 Human Capital Earnings Functions, An OLS Analysis

5.3.1 Introduction

To what extent do education and experience contribute to increasing employees' earnings in the manufacturing sector of Iran's Economy?

In the previous section, some descriptive evidence has been presented showing that there is a positive relationship between human capital measurements (i.e., education and experience) and earnings in the case of the manufacturing sector of Iran. As argued, there are some other factors that affect earnings of employees such as managerial position, firms' characteristics, etc. Isolating the separate effect of each determinant of earnings is not possible through the tabulation method. It is necessary to employ a regression technique to estimate an earnings function for that purpose. An earnings function relates variations in earnings to variations in explanatory variables such as education and experience. The regression derived coefficients could be either in general form, that is referring to, for example, the average contribution of an extra year of schooling to increasing earnings, or in educational level specific form. In this study, both techniques are employed.

So far, as Psacharopoulos states (1987: 218), earnings functions have been used for various purposes such as:

- isolation of the effect of one individual variable on earnings,
- rate of return analysis,
- income growth accounting,
- income distribution analysis,
- study of interaction effects, etc.

This study is mainly concerned with the first and last uses of earnings functions. That is we attempt to study the contribution of years of schooling and experience to earnings. We employ Mincerian earnings functions to fulfil the above purpose under the classic OLS approach. In this analysis, education, experience, and management are considered as main characteristics of employees and the size of firm, geographical location, and industry as firm's characteristics. In this section, the results of an OLS analysis are presented; in the first section, the estimated effects of employee variables on earnings are presented and then discussed. The section is followed by the examination of the effects of firm characteristics on earnings. Finally, attempts are made to evaluate the marginal effects of education and experience on earnings.

5.3.2 Employees' Characteristics

In what follows we attempt to estimate the effects of the conventional human capital variables on earnings by employing the basic Mincerian earnings function. As argued in chapter 3, the function with such a specification is not adequate for the analysis of earnings determinants in the context of the manufacturing sector in Iran. To examine this hypothesis, we extend the function through including variables for the interaction effect of years of schooling and years of experience on earnings, managerial responsibility, and non-linearity in the effect of schooling on earnings. Finally, the

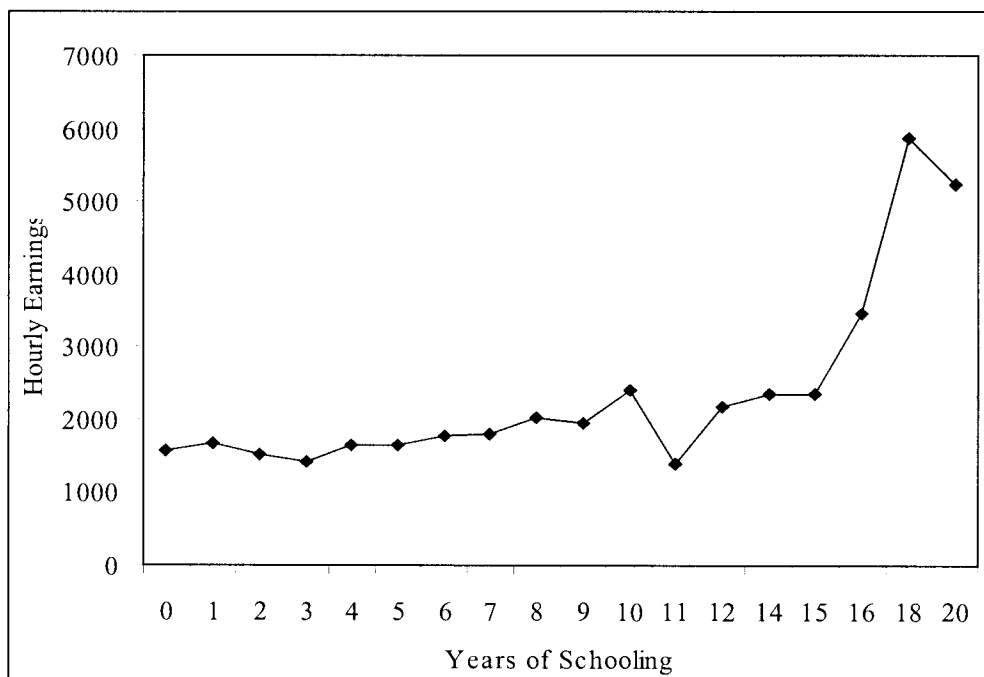
decomposition of experience into internal and external experience is of interest to see to what extent internal, in comparison with external, experience contributes to increasing earnings, which is the subject of the last part of this section.

5.3.2.1 Education and Earnings

Education as one of the key elements of human capital has been recognised in theoretical and empirical analysis of earnings differentials. Generally speaking, the function-derived estimates of the contribution of education to earnings could be either the contribution of an extra year of schooling or that of a higher level of education. In the former case we employ years of schooling as a continuous variable and in the latter case, four educational levels will be incorporated as dummy variables.

Years of Schooling and Earnings: Table 5.9 reports the results of runs of earnings functions consisting of individuals' characteristics. The variables included in Model 1 consist of years of schooling as the only explanatory variable. As results show, years of schooling explain about 8.3 per cent of hourly earnings differentials. In other words, some 8.3 percent of the earnings inequality in the distribution of employees' earnings can be attributed to individual differences in years of schooling. Under this situation, where (years of) schooling is added as the only explanatory variable, an extra year of schooling contributes some 2.64 per cent to increasing earnings. However, the relationship between years of schooling and earnings is not necessarily a linear one, as assumed in the basic Mincerian earnings function.

Figure 5.3: Relationship between Hourly Earnings and Years of Schooling



The empirical relationship between years of schooling and earnings is presented in Figure 5.3. The Figure suggests that there exists a non-linear relationship between the variables. We incorporate such non-linearity by adding years of schooling squared (i.e., “edun2” variable) into our earnings function, Model 2. Entering this new variable increases the explanatory power of the model (R^2 increases from 8.3 per cent to 10.3 per cent). That is, the model with a non-linear relationship between education and earnings can explain some 10.3 earnings differentials. The coefficient of ‘edun2’ is positive, indicating a higher contribution of schooling to earnings at higher levels of education. In other words, while years of schooling increases the contribution of years of schooling to earnings is getting larger. An employee with 10 years of schooling, for example,

would receive 4.2 percent more from one extra year of schooling. The corresponding figure for an employee with 16 years of schooling is 7.4 percent.

5.3.2.2 Experience and Earnings

As discussed in chapter 2, years of schooling is only one of the human capital variables. Individuals also accumulate their human capital through (on-the-job) training. We measure this variable by using years of experience. As is well established, the relationship between experience and earnings is concave to the origin (Figure 5.1: Earnings-Experience Profiles). This concavity, as human capital theory predicts, is due to the fact that investments are accumulated at younger age but continue at a diminishing rate throughout much of the working life mainly because of increasing marginal costs of investment with experience. (Mincer, 1974: 129) It means that individuals after graduation and at the start of their working lives invest in themselves much more than late in their working lives. In other words, the rate of post-school investment during working life is declining. At this stage, we enter years of experience and years of experience squared into the earnings function to account for such a relationship. In fact, the basic Mincerian earnings function is run that enables us to make a comparison between our empirical results and the findings of other studies. Doing this, it is found that the model can explain some 28.1 per cent of earnings differentials. (Model 3, Table 5.9) The marginal contribution of years of experience, derived by taking the first derivative of log-earnings with respect to the experience term, would be as follows:

$$\frac{\partial y}{\partial x} = \beta_x + 2\beta_{x^2}x = .0379 - (2*.0006)x \quad (5.1)$$

That is, an extra year of experience increases hourly earnings about 3.8 percent at the start of working life. At the end of the first decade of experience the figure is 2.6 percent and when X=20 the contribution of experience is only 1.4 percent. The negative sign of the coefficient of years of experience squared confirms the expected concavity: earnings increase with experience at a decreasing rate.

Table 5.9 Estimated Effects of Employees' Characteristics on Earnings

Variable*	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
edun	.0264 (37.80)	-.0121 (-5.6)	.0389 (60.1)	.0119 (6.0)	-.0070 (-2.8)	.0067 (2.8)
edun2		.0027 (18.8)		.0019 (14.5)	.0023 (17.0)	.0011 (8.9)
exp			.0379 (34.4)	.0387 (35.3)	.0279 (19.6)	.0311 (23.5)
exp2			-.0006 (-14.8)	-.0006 (-16.1)	-.0005 (-11.2)	-.0006 (-15.2)
sx					.001 (11.8)	.0003 (3.3)
mang						.446 (49.7)
cons	7.24 (1407)	7.33 (1069)	6.91 (770)	6.87 (699)	7.00 (483)	6.97 (517)
R ²	.083	.103	.281	.290	.297	.392
S.E.	.3586	.3547	.3176	.3155	.3141	.2921
F	1428	907.8	2051	1611	1328	1692

Note: In all tables in this chapter figures in parentheses are *t* statistics and all coefficients are statistically significant (at 10% or lower level), otherwise it is stated. Log-Hourly Earnings is also the dependent variable.

* Definitions of variables and notations used are presented in Appendix 1, Table A1.

Under the circumstances that experience and experience squared entered as explanatory variables, an additional year of schooling would increase earnings some 3.9 percent. This figure is 50 percent more than the schooling coefficient based on schooling earnings function (i.e., Model 1 of Table 5.9) in which we do not incorporate investment through experience. The result shows not only experience is an important variable but also ignoring post-school investment, through on-the-job training in our consideration, leads to bias in estimating the contribution of schooling to earnings.

Including years of schooling squared in the basic Mincerian earnings function (i.e. Model 4) improves the explanatory power of the model slightly. That is, the employed earnings function with years of schooling squared can explain about 29 percent of earnings inequality among employees.

The results of the basic Mincerian earnings function employed in this study, Model 3, are consistent with other empirical work. For example, in his well-known study Mincer reports that the earnings function including years of schooling, years of experience, years of experience squared can explain about 28.5 percent of earnings differentials. (Mincer, 1974:92; Table 5.1) The results of a study by Psacharopoulos and Layard (1979: 175, Table III, Regression 3.2) show that an earnings function with the same specification explain about 31.6 percent of variation in earnings. A study by Arabsheibani and Rees (1998: 190; Table 1, Column 1) provides similar empirical evidence: The three variables of years of schooling, years of experience, and years of experience squared explain about 22.3 percent of earnings variation.

5.3.2.3 Interaction Effect of Education and Experience on Earnings

The issue of schooling effects on post-school human capital accumulation has long been of interest. It is argued that employees with higher education are able to invest more through learning on the job. There should be, then, a positive relationship between schooling and post-school investment. To account for such an effect, an interaction variable for interaction between years of schooling and years of experience (i.e., “SX” variable) on earnings have been included in the human capital earnings function (Model 5). The coefficient for this variable as expected is positive and including the variable contributes slightly to increasing the explanatory power of the model. Therefore, the contribution of an extra year of experience in this situation depends on both schooling and experience. That is:

$$\frac{\partial y}{\partial x} = \beta_x + 2\beta_{x^2}x + \beta_{xs}s = .0279 - (2*.0005)x + .001s \quad (5.2)$$

The marginal effect of experience indicates that employees with higher education have received more additional earnings than those who are less educated partly due to their extra post-school investment. In other words, the greater volumes of investment through on-the-job learning imply steeper earnings-experience profiles for more highly educated people.

5.3.2.4 Management and Earnings

Earnings inequality due to occupation has long been a matter of debate in empirical analysis of earnings functions. On the one hand, it has been argued that ignoring occupation as one source of earnings differentials leads to bias in estimating the effects of human capital investments on earnings. On the other hand, it is claimed that better jobs are offered to better-qualified and educated workers. Therefore, access to better job is a consequence of higher schooling and experience. Under these circumstances, it is argued that including a variable to account for earnings inequality due to job variation thus would underestimate the effect of schooling. Our data can only allow us to distinguish managerial and non-managerial occupations. Therefore, we first ran a human capital earnings function for employees with no managerial position. The results of this model would show whether or not including a variable for managerial responsibility understates the effect of schooling on earnings.

Table 5.10 shows the contribution of schooling on earnings based on the human capital earnings functions 5 and 6 presented in Table 5.9. It indicates that schooling effects under different situations are not the same. Under earnings function 5, for example, the contribution of schooling is much more than the situation where managerial responsibility (i.e., 'mang') is included as an explanatory variable. To see whether the difference is bias in the estimated effects of schooling, we ran a separate earnings function under which employees (observations) with managerial position have been excluded. Row 3 of Table 5.10 presents the results and indicates that the estimated effects of schooling are very close to those of model 6 including 'mang' variable.

Therefore, an earnings function excluding managerial responsibility, as in Model 5, may overstate the effects of schooling years on earnings.

However, it should be noted that it does not mean schooling and experience do not have anything to do with managerial responsibility. It could be argued that job seniority (i.e., management) is another kind of human capital. Because access to such jobs and positions could be costly. For example, candidates may need to attend special courses for the purpose of being a manager. Better workers are also selected into higher level jobs. (Ferrall, 1997: 27) This selection could be due to better quality of schooling and experience as well as higher ability. Regardless of the issue of innate ability, both quality of schooling and quality of off-school investments are theoretically the components of human capital acquired through education and experience. However, years of schooling and experience do not account for such components. Besides, higher level jobs could provide a better opportunity for investment through on-the-job learning. Such elements can create additional human capital accumulation and in turn steeper earnings-experience profiles for managers.

Thus, it is more desirable to include “management” as another explanatory variable to account for such effects. By doing this, we find that being a manager increases hourly earnings some 45 percent. In these circumstances, the human capital earnings function, Model 4, explains more than 39 percent of inequality in the distribution of workers’ earnings.

Table 5.10: Estimated Effects of Schooling on Earnings (%)

	Condition	N	S=10		S=20	
			X=0	X=10	X=0	X=10
1	Including 'mang'; Model 6	15755	2.9	3.2	5.1	5.4
2	Excluding 'mang'; Model 5	15755	3.9	4.9	8.5	9.5
3	Excluding observations where 'mang=1'*	14269	2.8	3.2	5.2	5.6
4	(2) - (1) [Bias!!]		1.0	1.7	3.4	4.1

Note: The schooling estimates are based on $\partial y / \partial s = \beta_s + 2\beta_{s^2} + \beta_{sx}x$.

* The exclusion of observations where mang=1 might raise the issue of sample selection problem. To examine whether the matter of sample selection would affect the estimates, we used Heckman two-step estimation procedure, *Heckit*. It was found that the coefficient of lambda is not significant at 10% or better level and, therefore, the estimates of earnings function 3 do not suffer from the problem of sample selection.

Table 5.11: Probability of being a Manager Associated with Education and Experience

X↓	S→	5	12	16	18
10		0.011	0.206	0.570	0.741
20		0.087	0.475	0.734	0.822
30		0.262	0.578	0.713	0.762

Note: To estimate the probability, a logistic model consisting of S, S², X, X², and SX was employed. S stands for years of schooling and X for years of experience.

There is also another point that should be elaborated. As stated above, more educated and experienced persons are selected for higher level jobs. Therefore, the issue of the option value of education and experience emerges from the job seniority. To deal with this issue, we employ a logistic model to evaluate the probability of being a manager due to higher education and more experience. Table 5.11 reveals the results. It indicates that the probability of being a manager increases with years of schooling and with years of experience. For example, the probability of being a manager for a person

with 12 years of schooling and 10 years of experience is about 21 percent. The equivalent figure for an individual with 16 years of schooling and 20 years of experience is about 73 percent. Therefore, it is plausible to assume that for an individual with the latter characteristics about 73 percent of earnings differentials attributed to management can be ascribed to the option value of education and experience.

5.3.2.5 Internal and External Years of Experience and Earnings

As suggested in chapter 3, years of experience can be decomposed into two elements; Experience inside the current firm and prior or external experience in other firms. It is expected that internal experience would have a larger effect than external experience on earnings of employees since the former one is more relevant to the current job. In this connection we estimated earnings functions to evaluate the relative effect of the two kinds of experience on earnings. Table 5.12 shows the results and all estimated earnings functions provide empirical evidence on the fact that internal experience has a stronger effect on earnings than prior experience (about twice). Model 1, for example, shows that an extra year of internal experience contributes some 1.9 percent to increasing hourly earnings in comparison with 0.8 percent of a year of external experience. The same results are held for Model 4, Table 5.12. That is one extra year of internal experience increases earnings about 2.8 percent and the equivalent figure for external experience is 1.4 percent.

In terms of the explanatory power of earnings functions, it should be noted that decomposing experience into internal and external experience slightly improves the R^2

of the models. For example, earnings function 6, Table 5.9, consisting of a variable for total years of experience, explains about 39 percent of earnings differentials while the comparable earnings function 4, Table 5.12, consisting of two separate variables for internal and external experience, has better explanatory power (i.e., 40.7 percent).

Our findings reported above are consistent with the results of other empirical work. Mincer and Higuchi (1988: 105, Table 1), for instance, report that (i) internal experience (i.e. tenure in their terminology) has a stronger effect on wages in both Japan and the United States and (ii) the growth of wages with tenure in Japan is greater than that in the U.S.

Table 5.12: The estimates of effects of internal and external experience on earnings

	1	2	3	4
Edun			-0.0079 (-3.4)	-0.0031 (-1.3)
Edun2			0.0019 (14.8)	0.0018 (14.0)
EXPint	0.0185 (45.9)	0.0283 (23.2)	0.0165 (28.0)	0.0280 (21.2)
EXPext	0.0075 (10.3)	0.0192 (12.3)	0.0009 (1.14)	0.0141 (9.0)
EXP2		-0.0004 (-8.5)		-0.0004 (-9.7)
SX			0.0006 (8.3)	0.0004 (4.5)
Mang			0.4261 (47.9)	0.4330 (48.7)
CONS	7.19	7.14	7.08	7.01
R² (%)	11.91	12.31	40.34	40.69

Note: Figures in brackets are t-statistics. The coefficients shaded are not statistically significant at 10 percent level.

EXPint and EXPext stand for internal and external years of experience, respectively.

So far, we have examined the effects of employees' characteristics on earnings through employing earnings functions and found that all coefficients, according to *t* statistics, are highly significant and consistent with the human capital theory as well as most other empirical studies. That is, investments in human capital through education and experience lead to higher earnings and the results tend to support the notion that individuals develop their (future) earnings capacities through education and on-the-job learning. In other words, the observed correlation between human capital variables (schooling and experience) and earnings provides support for the hypotheses that education and learning through experience are investments which receive pecuniary returns in the labour market.

As discussed above, the relationship between years of schooling and earnings is found to be non-linear. Nevertheless, this non-linearity is assumed in the way that the incremental effect of an extra year of schooling is independent of different educational levels. However, it is not necessarily the case. That is, in reality the contribution of an additional year of schooling to earnings may be different across different levels of education. (Bowman, 1961: 247) The following section deals with this issue.

5.3.2.6 Variation in Contribution of Years of Schooling with Levels of Education

Human capital theory does not predict to what extent years of schooling at different educational levels contribute to earnings. In other words, it is not clear theoretically, as elaborated in chapter 2, whether or not the contribution of schooling in different educational levels should be the same. For example, does an extra year of

schooling in primary level increase earnings as much as a year in tertiary level? To achieve an equilibrium, however, in life-cycle theory of earnings it is assumed that return to education is diminishing. (Willis, 1986: 551-4; and Cooper and Cohn, 1997: 108-9) If this is the case, the contribution of years of schooling to earnings derived from Mincerian earnings function, which is conventionally considered as return to education, should decrease with years of schooling as the proxy of investment in human capital through education. However, empirical investigations of this aspect of human capital theory provide conflicting results. For example, Mincer in his well-known work (1974: 54, 92) found a decreasing rate of return to schooling derived from an earnings function where he excluded hours of work. However, the rate was found to be constant when he entered hours of work as another explanatory variable. Mincer and Higuchi's study (1988: 125; Table AII, Regression A) using data of Japan and USA presents different patterns of the non-linear relationship between years of schooling and earnings. As the findings of the study show, in the case of Japan, the coefficient of years of schooling squared is negative indicating that years of schooling increase earnings but do so at a decreasing rate. In contrast, in the case of the United States the coefficient of years of schooling squared is found positive demonstrating the point that years of schooling improve earnings at an increasing rate. Psacharopoulos and Layard (1979: Table III, Model 3.3) in the case of Britain and Kingdon (1997: 26) in the case of India have also found an increasing rate of the contribution of schooling years to earnings, which is consistent with the findings presented above. However, by including years of schooling squared as a continuous variable in an earnings function it is implicitly assumed that years of schooling increase the marginal effect of schooling on earnings but do so at a

constant rate. In reality, this may not be necessarily the case. By using a dummy variable for each educational level we relax this assumption.

Running an earnings function consisting of dummy variables for different educational levels, we have found a non-linear relationship between education and earnings. That is, the contribution of an extra year of schooling to earnings increases with levels of education. Table 5.13 reports the results of our experiments. As can be seen from the results of earnings function or Model 1, education level 1 (i.e. “DS21” variable) contributes about 6.7 percent to earnings in comparison with the base education level. Education level 2 (secondary education) increases earnings about 11 percent more than that of education level 1. Finally, the effect of education level 3 (higher education) on earnings is 46 percent more than that of education level 2. Overall, the effect of higher education level in comparison with the base education level is 63 percent (i.e., 15.5 percent per year of *higher education*).³ The equivalent figures for secondary education level is 17.3 percent (4.3 percent per year). Earnings functions 2 and 3, Table 5.13, including experience and management variables, also show the same patterns: the effect of education on earnings increments with levels of education

³ To formulate an equation that reveals differences between the effects of different educational levels on earnings through using dummy variables, there are two alternatives; one is to employ a binary variable in the way that a comparison is made between the base or control educational level and the highest education level. That is, the dummy variable take on the value 1 if an individual has that particular education level and zero otherwise. To compute the marginal effect of each educational level to its previous level of education one has to subtract the coefficient of lower level from that of higher level. The other is to redefine the dummy variables to be 1 if the individual has the degree, rather than whether the degree is the highest degree obtained. For example, for someone with a Higher Education level, all binary variables for higher education, secondary education, and primary are 1. In this way of formulation, the coefficient of each level of education gives the marginal value of the level to earnings. (More explanation is given in: Greene, 1993: 231-6.) The second method is used in this study to evaluate the marginal effect of each educational level on earnings.

and the effect of higher education is the highest among the levels of education. For instance, higher education level, based on earnings function 2, increases earnings by 46 percent, compared with secondary education level. The corresponding figure for secondary education level is 14 percent.

Table 5.13: Estimated Effects of Employees' Characteristics on Earnings Using Dummy Variables

Variables	1	2	3
DS21	.0669 (10.2)	.1478 (24.6)	.1059 (18.9)
DS22	.1065 (14.1)	.1388 (20.5)	.0903 (14.2)
DS23	.4559 (27.3)	.4575 (31.3)	.2859 (20.1)
EXP		.0387 (35.0)	.0339 (33.1)
EXP2		-.0007 (-16.8)	-.0006 (-18.0)
MANG			.4594 (51.9)
CONS	7.32 (1572)	6.91 (810)	6.97 (874)
R ²	.1019	.2805	.3857
S.E.	.3549	.3177	.2936
F	596.0	1227.7	1648

Note: 0- 4 years of schooling completed have been considered as the base or control education level and 5-8, 9-12, and 13+ years of schooling completed as education levels 1, 2, and 3 respectively. Estimated coefficients of educational levels show the marginal effect of each education level to lower level of education rather than to the base level of education.

DS21, DS22 and DS23 are dummy variables used for education levels 1, 2 and 3, respectively.

The incremental effect of education on earnings with level of education can be viewed as evidence to support a number of hypotheses concerning investment in human

capital through education. It can be viewed in the way that higher levels of education, compared to lower levels of education, are more vocationalized and occupationalized in the sense that students are thought subjects, which are more relevant to a specific job. (Williams, 1985) In other words, if we consider the essential contribution of education in terms of the dissemination of knowledge of both the know-how and know-what types, skill and cognitive knowledge, this finding also sheds light on the fact that primary and secondary levels of education provide students mainly know-what knowledge rather than know-how kinds of knowledge. In contrast, higher education supplies mainly know-how knowledge, which is more relevant to a job. (Machlup, 1984: 432-4)

The above mentioned patterns of earnings differentials can also be presented in connection with the assumption that a student studying at a higher level of education can invest more in himself compared to a student studying at secondary or primary level. It is expected that this extra capability of human capital accumulation, therefore, improves earnings capacity. It is worthwhile mentioning that the higher ability/capacity accumulating human capital may be a result of higher innate ability or additional knowledge and skills acquired at schools and universities. In the latter case, the findings support human capital theory and in the former one the screening hypotheses. However, as stated in chapters 2 and 3, regression techniques are not able to shed light on this important issue.

Finally, as observed in chapter 4, the number of students and graduates of the higher education institutions in Iran increased dramatically during the last decade. The

higher contribution of an extra year of schooling at higher education level is an explanation for that phenomenon. That is, it can be regarded in the way that students were motivated by economic factors, in particular earnings, to continue their education.

However, as presented above, the improving earnings capacity does not necessarily mean that the rate of return to education also increases. Costs of education for different individuals, due to differences in abilities and opportunities, and for different educational levels are not the same. Besides, there are other benefits such as employability, trainability, etc. that are attributed to education. Human capital analysis of earnings using earnings functions take no account of all the productive attributes developed by education, as Mace (1987: 28) remarks. Thus, we should be cautious about the common practice of interpreting the coefficient for years of schooling as the rate of return to education.⁴ If we interpret the coefficients of years of schooling as return to education neglecting, e.g., direct cost of education it is likely that we face contradictory results with the life-cycle theory. That is, under such circumstances there would not be an achievable equilibrium for an individual investing in himself through education and he would continue his formal education for ever. In reality, however, it is not the case. Therefore, the coefficient of schooling in the Mincerian earnings function cannot be interpreted as returns to education but as the contribution of schooling to earnings. To evaluate the returns to education one has to incorporate direct cost of

⁴ A more detailed discussion is given in Johnes (1993a: 30-31).

schooling as well.⁵ In other words, the assumption that direct cost of education is negligible or is the same for different educational levels, as most empirical studies using Mincerian forms of earnings function reviewed in chapter 2 claim, does not seem plausible.⁶

As mentioned earlier, besides the employees' variables there are some other factors affecting employees' earnings. Taking into account these factors may also influence the schooling and experience coefficients. The extent to which these variables contribute to earnings and affect the marginal effects of schooling and experience is studied in the following section. In the next section, therefore, we will analyse the effects of firms' characteristics on earnings using OLS methodology.

5.3.3 Firm Characteristics and Employees' Earnings

In the previous section, we presented the results of earnings functions using employee characteristics as explanatory variables. It was assumed that there is no firm effect on employee earnings, if there is, the firm effect is the same for all employees. In

⁵ Although little attempt has been made to investigate whether the coefficient of years of schooling derived from Mincerian earnings function can provide an unbiased estimation of return to education, Psacharopoulos and Layard state that only if the investment ratio, k_i , and the rate of return to post-school investment are independent of schooling and experience the coefficient on years of schooling is an unbiased estimator of the rate of return to schooling. (Psacharopoulos and Layard, 1979: 169) As their findings and ours show they are dependent on schooling and, therefore, schooling coefficient derived from Mincerian earnings function is a biased estimation of return to education. As a result, in this study we do not intend to interpret the schooling coefficient as return to education.

⁶ An interesting critique of the estimates of rates of return to education is provided by Bennel (1996). A more detailed discussion concerning costs of education is given in Verry (1987).

this section such an assumption is relaxed and an attempt is made to include firm variables (size, geographical location, and industry) in earnings functions to investigate the contribution of these variables on earnings.⁷

Model 1 of Table 5.14 includes the size of firm using dummies. For that purpose, the firms are divided into three categories; firms employing between 0 and 99 employees, as the base group; firms whose number of employees are between 100 and 999; and firms that employ 1000 or more people.⁸ The results are presented in Table 5.14 and indicate that the size dummies slightly improve the explanatory power of the earnings function. (R^2 increases from 39.2 percent to 40 percent.) The coefficient for the size variables (i.e. SizeD2 and SizeD3) indicate that firms categorised into the group two pay some 1.3 percent more to their employees in comparison with firms employing fewer than 100 people. The equivalent figure for a firm with 1000 or more employees is 7.1 percent. After controlling for geographical location and economic sector or industry, we find that the coefficients of dummies for the size of firms are 3.9 and 7.4 respectively. The findings, therefore, indicate that larger firms pay more to their employees, holding individuals' human capital variables constant.

⁷ It is worthwhile mentioning that human capital theory deals with individual as unit of analysis. By including firm's variables into human capital analysis of earnings, we inevitably enter the situation that the analysis involves two kinds of unit; individuals and firms in which individuals are clustered. From the viewpoint of statistics it is possible to include limited aspects of firms' characteristics through applying dummy variable technique when a single-level of analysis is employed. In this section we attempt to include size of firm, geographical location, and sector/industry by using dummy variables. More detailed consideration of firm's characteristics is presented in chapter 6, the Multilevel Analysis.

⁸ Such categorisation is adopted because it enables us to employ dummy variables and to compare the results with those of other empirical studies.

Table 5.14: Estimated Effects of Employees and Firms' Characteristics on Earnings

	Model 1	Model 2	Model 3
edun	.0039 (1.6)	-.0045 (-2.0)	-.0087 (-4.0)
edun2	.0013 (10.2)	.0015 (12.4)	.0016 (13.9)
exp	.0303 (22.9)	.0260 (20.6)	.0272 (22.6)
exp2	-.0006 (-15.3)	-.0006 (-16.3)	-.0006 (-17.6)
sx	.0003 (3.7)	.0005 (6.8)	.0004 (5.9)
mang	.4467 (49.9)	.4346 (51.0)	.4006 (49.1)
SizeD2	.0129 (1.0)	.0294 (2.4)	.0385 (3.2)
SizeD3	.0712 (5.6)	.1078 (8.8)	.0743 (6.4)
LocnD		.2052 (40.4)	.1388 (27.2)
SctrD			.2336 (40.0)
cons	6.94	6.85	6.88
R²	.3976	.4543	.5046

Note: The number of employees is considered as firm's size. Firms are divided into three categories: firms employing between 0-99 employees (i.e., base or control group), firms whose number of employees are between 100 and 999 (i.e., SizeD2), and firms that employ 1000 or more persons (i.e., SizeD3).

Geographical location is included by using dummy variable (LOCN=1 if the firm located in a big city having population more than one million and =0 otherwise).

The firms are grouped into two; group 2 (i.e., SctrD) consisting of firms supplying services such as transportation, commercial and trade,⁹ and group 1, base group, consisting of firms producing manufacturing goods such as textile, food, car parts, electronic products, and non-metallic mineral products.

⁹ The firms supplying such services might be regarded as units of the service sector rather than the manufacturing sector. It should be noted that these particular firms provide transportation, distribution, and exportation services for specific producers of manufacturing products. In fact, such services should have been provided by the appropriate department of the producers. Perhaps for this reason the firms providing the services regard themselves as manufacturing units rather than units of the service sector. For the purpose of statistical analysis and since the nature of their activities is different from that of other firms, a dummy variable is employed to account for such differences.

Our findings reported above are consistent with other empirical studies. For example, Siebert and Addison (1991; quoted in Polachek and Siebert, 1993: 261) using British data find that plants employing 1000 or more pay 8 percent more than small plants (employing 100 or less), holding constant the usual human capital variables plus occupation and industry.

It is also argued that geographical location is one of the determinants of earnings. Firms located in big cities may pay more to their employees. To study this point, we include geographical location in the earnings function by using a dummy variable that takes on the value 1 if the firm is located in a big city and zero otherwise. (Model 2) We find that an employee working in a firm located in a big city earns some 20.5 percent more than an employee who works in a firm located in a small city. Moreover, including geographical location improves the explanatory power of our model considerably, that is by 14 percent.

Different firms in different industries may behave differently with respect to employees' pay. To deal with this issue we classify our observations at firm level into two categories; firms producing mainly services such as transportation and distribution, and trade and commercial services, group 2; and group 1 consisting of other firms, the base or control group. At this stage we incorporate the matter of industry by defining a dummy variable, it takes on 1 when the firm belongs to group 2 and 0 otherwise. Doing this, we find that the employees working in firms classified as group 2 receive some 23.4 percent more than their counterparts working in group 1 firms.

The results reported above are consistent with other empirical studies. Mincer and Higuchi (1988) using the United States and Japanese data study the effect of industry on wage and wage growth-tenure by employing a dummy variable for each of 16 industries and an interaction variable (i.e. industry-dummies multiplied by tenure) for interaction between industry and tenure on wage. They have found significant effects for most of 16 industries used in their study. For example, based on their investigation, an employee working in Publishing and Printing industry of the U.S. earns 22.6 percent less per hour than his counterpart working in mining industry (i.e. the base industry). The equivalent figure for the case of Japan is the reverse, that is a person working in publishing industry is paid 65.6 percent more than his counterpart in mining industry. The coefficients for interaction between industry and tenure for the US and Japan are 1.14 and -0.63 percent respectively. (Mincer and Higuchi 1988, Table AIV: 129-130)

5.3.4 Marginal Effect of Education and Experience on Earnings

As reviewed in chapter 2, returns to schooling derived from Mincerian earnings functions employed in empirical analyses of earnings have been criticised because such analyses ignore some relevant variables. It has been argued that the omission of such variables leads to bias in estimates of return to schooling. Of these variables at the firm level are firm's size, geographical location, and industry. As presented above, the results of the analysis show that all these variables significantly affect earnings of employees and, therefore, ignoring these variables may lead to bias in the estimated

coefficients. The extent of bias depends on the relationship between existing explanatory variables and omitted ones.

To study the bias due to firm variables, we compare the contribution of years of schooling derived from model 6 of Table 5.9, from which the firm level variables are omitted, and model 3, Table 5.14, in which the firm level variables are included. Table 5.15 presents the results. It shows that at lower levels of education and earlier working life (experience) marginal contributions of schooling years derived from model 6 are overestimated. In contrast, the effects of years of schooling on earnings at higher levels of education are underestimated. The marginal effect of schooling for an individual with, say, 10 years of experience and 5 years of schooling is overstated about 45 percent. The equivalent figure for a person with 30 years of experience and 18 years of schooling is -10 percent showing an underestimated effect.

The results of the OLS analysis, therefore, indicate that the basic Mincerian earnings function is not appropriately specified for the purpose of examining earnings differentials in the manufacturing sector of Iran, and needs to be extended by incorporating the firm variables. Moreover, using OLS methodology, we were not able to examine the question why larger firms pay more to their employees. We do this in part in the next chapter.

Table 5.15: Marginal Effects of Years of Schooling on Earnings (%)

		β_s	S=5	S=12	S=16	S=18
1	X=10	$\beta_{s,a}$	2.07	3.61	4.49	4.93
2		$\beta_{s,b}$	1.13	3.37	4.65	5.29
3		Bias	45.4	6.6	-3.6	-7.3
4	X=20	$\beta_{s,a}$	2.37	3.91	4.79	5.23
5		$\beta_{s,b}$	1.53	3.77	5.05	5.69
6		Bias	35.4	3.6	-5.4	-8.8
7	X=30	$\beta_{s,a}$	2.67	4.21	5.09	5.53
8		$\beta_{s,b}$	1.93	4.17	5.45	6.09
9		Bias	27.7	1.0	-7.1	-10.1

Note: The schooling estimates are based on $\partial y / \partial s = \beta_s + 2\beta_{s^2}s + \beta_{sx}x$.

$\beta_{s,a}$ and $\beta_{s,b}$ stand for the marginal effects of schooling derived from Model 6, Table 5.9 and Model 3, Table 5.14, respectively.

5.3.5 Summary and Conclusions

In this section we have presented the results of the OLS analyses of earnings differentials. We found that investment in human capital through experience and education improves the earnings of an individual. Our findings also provide evidence on the proposition that an individual with higher level of education can invest more through on-the-job training (experience). The results of the analysis provide evidence that the marginal effect of schooling on earnings increases with level of education. In fact our empirical data enables us to relax the restrictive assumption that the effect of schooling on earnings is independent of levels of education. This evidence can be interpreted in the way that greater capability of human capital accumulation at higher

levels of education would lead to incremental effect of education on earnings. It also provides evidence to support the hypothesis that at higher levels of education individuals also acquire knowledge, which is more specific and more relevant to do a job. Such human capital accumulation is rewarded in the labour market with higher earnings, pecuniary benefits.

In connection with the issue of biased estimates of schooling on earnings, attempts were made, through adding dummies in earnings functions, to eliminate earnings variation due to job seniority and some characteristics of firms. The OLS findings like most empirical studies, reviewed in chapter 2, show that these factors are important in the determination of earnings and that ignoring such earnings determinants leads to bias in the estimation of the effects of education on earnings. The bias, however, varies with level of education and experience.

As explained above, job seniority is in part due to more education and experience. Our data enabled us to examine the probability of having a high level job as a result of higher education and more experience. Such findings help us to demonstrate that up to 80 percent of earnings differentials attributed to management could be ascribed to the option value of education and experience.

Although through conducting the OLS analysis of earnings differentials we were able to evaluate the effects of human capital factors, after eliminating the effects of some non-human capital variables on earnings, there are still some other variables affecting earnings, which due to the limitation of a single-level method of analysis we could not incorporate in an earnings function. More importantly, as elaborated in

chapter 3, we think that most economic data like that we use in this study are dominated by a hierarchical structure. In practice, such a structure may relax one or two of the basic assumptions of a single-level method of analysis (i.e. OLS). This relaxation or rejection of the assumptions may mislead us in hypothesis testing. These issues will be examined and elaborated in the next chapter, through employing a multilevel analysis of earnings.

Chapter 6 Earnings Functions; A Multilevel Analysis

6.1 Introduction

In the previous chapter the results of a human capital analysis of earnings were presented. The analysis is based on employing the OLS methodology. The effects of human capital variables and only some aspects of firm characteristics on earnings were examined. However, we did not incorporate all firm variables in the analysis due to the limitation of the single-level method of analysis. The findings of the analysis, like many other empirical studies reviewed in chapter 2, has indicated that human capital as well as firm variables are important determinants of earnings. Thus, to have unbiased estimates of human capital variables one has to include other determinants of earnings in an earnings function. In this chapter attempts are made to extend the basic earnings function, introduced in chapter 5, through employing multilevel techniques. As discussed in chapter 3, the classical OLS analysis is based on specific and basic assumptions and so far little attention, if any, has been devoted to examining the validity of one or two of the basic assumptions, which may dramatically affect the results of an analysis. In this chapter, the validity of such assumptions is empirically examined.

We also study the advantages of employing a multilevel technique in the context of human capital analysis of earnings. Attempts are made to evaluate the marginal

contribution of schooling and experience on earnings, after incorporating the cluster effects. The chapter ends with the section of concluding remarks.

6.2 Examination of OLS Assumptions

One of the assumption on which the OLS method is based is that the covariance between two observations is zero, $Cov(u_s, u_t) = 0$. It means that error terms of the units of analysis (i.e., employees) are not correlated and employees are not clustered and grouped into, for example, firms. If they are, the effect of clustering on their earnings is assumed to be similar for all workers. (Figure 6.1 depicts an estimated earnings-experience profile using the single-level method, OLS.) In reality, however, not only employees are clustered within firms but also the structures and organisations as well as the nature of their activities are different from each other. This hierarchical structure, in terms of multilevel methodology, affects the earnings of employees differently and, therefore, the effects of education and experience on earnings vary from one cluster to another.¹ In such a case, the covariance of error terms of, for example, two employees in a cluster/firm is not zero, $Cov(u_s, u_t) \neq 0$. That is, earnings of employees in a firm are correlated to each other, partially because they are working in the same company and under a single management. In other words, there are some factors such as firm size, geographical location, industry, etc. that may affect earnings of employees working in the same firm regardless of their qualifications. Therefore, the effect of these factors makes a correlation between their earnings. Nevertheless, the covariance between

¹ The effects of hierarchical structure on earnings are elaborated in detail in chapter 3.

earnings of two employees working in two different firms can still be assumed zero.² In this section, we examine our data to find out whether the data are dominated by a hierarchical structure. As elaborated in chapter 3, the intra-unit correlation statistic is used for this purpose.

To test the existence of a hierarchical structure, earnings functions were run with no explanatory variables using both OLS and multilevel methodology. In addition to examining the existence of a hierarchical structure, this also enables us to find out the attribution of the units of each level to earnings differentials. Table 6.1 shows the results and indicates that the mean and the variance of the unconditional Model 1 are 7.41 and 0.1402, respectively. It indicates that log hourly earnings of an employee on average is 7.41. In this model no firm effect on earnings is assumed. We can decompose the variance of the model into two elements: one of first level and the other of the second. This decomposition can show whether firms have any effect on earnings. Model 2 was estimated and indicates that 53 and 47 percent of earnings differentials can be attributed to the employee and firm level, respectively. It demonstrates that, besides the employee characteristics, firm characteristics can also explain a large portion of earnings differentials among the employees. The random part at level 2 is very significant (based on likelihood ratio changing from 13763 to 3061 with one new parameter), which shows that this parameter (intercept) should be considered as a random coefficient. Firms, therefore, do play a significant role in earnings variation. It also provides evidence that covariance between two employees working in the same firm is non zero. The findings

² It is worthwhile noting that since units of higher level of analysis in this are firms, we assume a zero covariance between two observations in two different firms. However, if we had three levels of analysis consisting of individuals as units of first level, firms as the second, and industries as the third, we would put the same assumption for the industry units as the units of higher level. In such a case it would be plausible to assume a non-zero covariance between units of an industry, say firms.

indicate that data used are dominated by a hierarchical structure, and to obtain reliable estimates the application of multilevel techniques is needed.

Table 6.1: Decomposition of Earnings Variations into Levels 1 and 2

	Model 1		Model 2	
	<i>Parameter</i>	<i>t stat.</i>	<i>Parameter</i>	<i>t stat.</i>
Fixed Part:				
Cons*	7.41	2483	7.39	175
Random Part:				
<i>Level 2:</i>			0.0621	
cons/cons (σ_{uo}^2)**				
<i>Level 1:</i>	0.1402		0.0703	
cons/cons (σ_{eo}^2)				
Intra-Firm Correlation***	0		0.469	
$-2 * \log(lh)^{\clubsuit}$	13763		3061.2	

Note: * 'cons' stands for constant term or intercept of a model.

** 'cons/cons' or σ_{uo}^2 is variance associated with intercept.

*** The intra-firm correlation ($= \sigma_{uo}^2 / (\sigma_{uo}^2 + \sigma_{eo}^2)$) measures the proportion of the total variance which is between-firms. (Goldstein, 1995: 19)

\clubsuit Likelihood ratio is used for testing of hypotheses especially for the random part of a model.

In other words, when data used are dominated by a hierarchical organisation it is argued that the results based on an OLS analysis are not completely reliable and *t*-statistic may mislead us in testing of hypotheses. Going one step towards reality, therefore, we have to include the hierarchical structure in our considerations through using a multilevel analysis. For that purpose, two issues need to be examined: whether the coefficients of the human capital variables should be considered as random parameters varying across firms, and whether the hierarchical structure will affect the results of the analysis. The following section attempts to examine these issues by employing a two-level method of analysis, which is based on varying coefficient models.

6.3 Varying Coefficients

To investigate the issue of varying coefficient structure, we employ the basic earnings function (6.1), which is an extended form of Model 2 of Table 6.1:

$$y_{ij} = \beta_{0j} + \beta_s S_{ij} + \beta_{ss} S_{ij}^2 + \beta_x X_{ij} + \beta_{xx} X_{ij}^2 + \beta_{sx} S_{ij} X_{ij} + \beta_m M_{ij} + e_{ij} \quad (6.1)$$

where S, X, and M are years of schooling, years of experience and management, respectively. Earnings function (6.1) is used to study whether or not the intercept term and the coefficients of schooling, experience, experience squared, and management vary across the firms.³ By carrying out this experiment we, in fact, are able to investigate whether firms reward human capital investments differently.

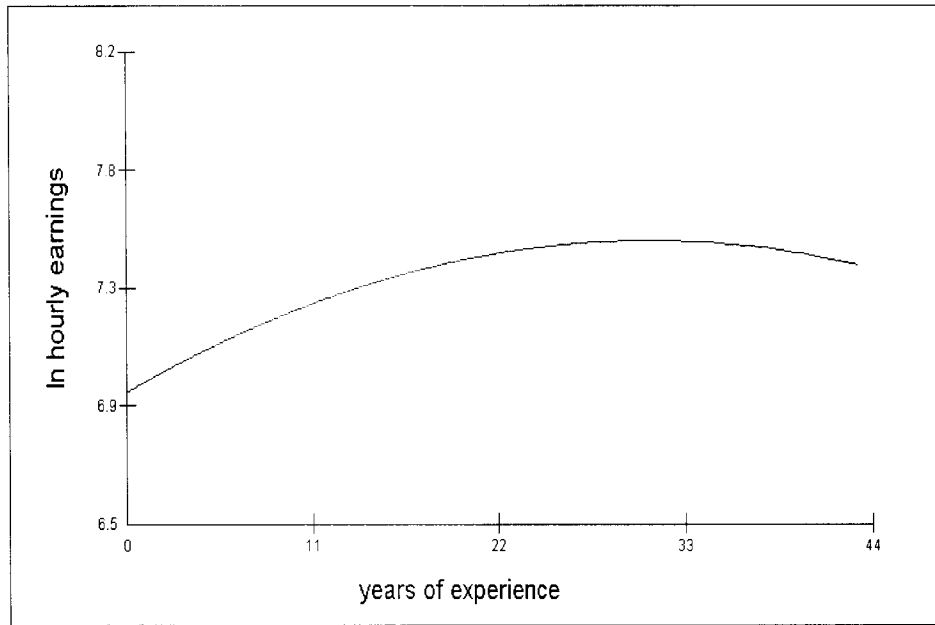
Table 6.2 shows the results of the experiments. In column 2 the results of an earnings function in which intercept is considered as the only varying coefficient are presented. The findings show that the likelihood ratio⁴ decreases dramatically, as compared with that of column 1, and indicates that the intercept should be considered as a varying coefficient. That is, employees with no educational qualification and at the beginning of their working life earn differently across firms.⁵ Figure 6.2, drawn based on the earnings function 2 of Table 6.2, depicts such a relationship. As can be seen, each firm had a different starting wage/salary, holding human capital variables the same.

³ The methodological issues have been elaborated in chapter 3.

⁴ For the purpose of hypothesis testing in this study we use *t statistic* to evaluate the significance of a single parameter at the fixed part of a multilevel model and *likelihood ratio* for the random part, as Goldstein suggests. (Goldstein, 1995: 33-35)

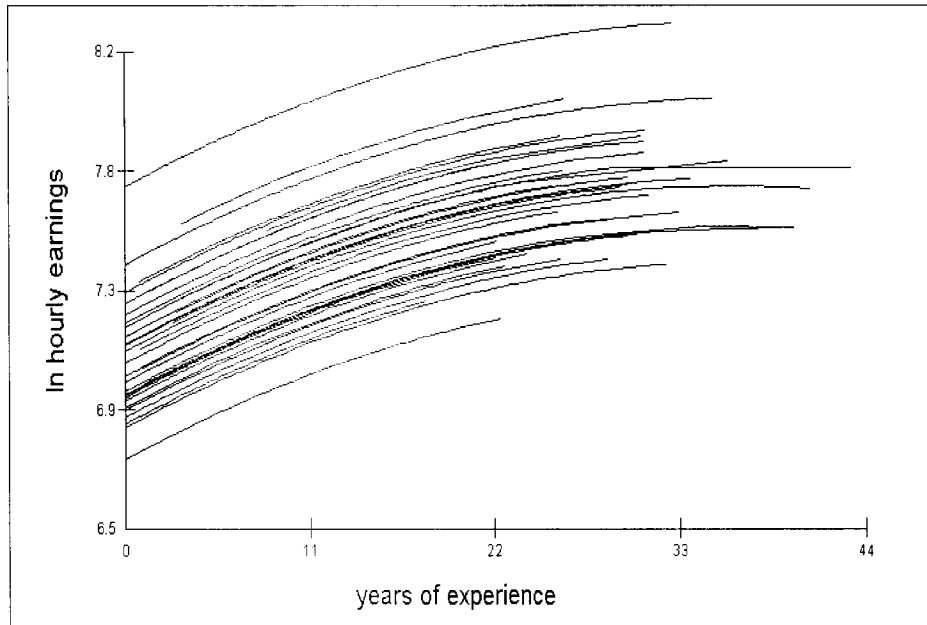
⁵ At this stage we do not intend to explain why different firms pay differently to their workers. Later in this chapter appropriate discussion in this regard will be provided.

Figure 6.1: Estimated Earnings-Experience Profile for all Employees (OLS)



Note: The earnings-experience profile is drawn based on the estimated earnings function 1 of Table 6.2.

Figure 6.2: A separate Estimated Earnings-Experience Profile for each Firm (varying intercepts)



Note: The earnings-experience profiles are drawn based the estimated earnings function 2 of Table 6.2.

Considering a varying structure for the coefficient of years of schooling we achieve the same conclusion (based on the likelihood ratio that changes from -5708.7 to -6064.5, Model 3). That is, the contribution of an extra year of schooling to earnings varies among the units of the second level. It shows that investment in human capital through schooling is rewarded differently across firms.

Table 6.2: Estimated Effects of Employees' Characteristics on Earnings using Multilevel Methodology

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Part						
EDUN	.0067 (2.8)	-.0213 (-12.5)	-.0175 (-6.8)	-.0171 (-6.6)	-.0172 (-6.6)	-.0162 (-6.3)
EDUN2	.0011 (8.9)	.0023 (25.5)	.0020 (21.8)	.0020 (21.7)	.0020 (21.8)	.0020 (21.7)
EXP	.0311 (23.5)	.0210 (22.1)	.0200 (20.8)	.0198 (15.3)	.0197 (14.6)	.0203 (12.3)
EXP2	-.0006 (-15.2)	-.0005 (-16.7)	-.0005 (-17.0)	-.0004 (-15.5)	-.0004 (-11.3)	-.0004 (-8.9)
SX	.0003 (3.3)	.0007 (12.4)	.0009 (15.1)	.0009 (13.7)	.0009 (13.7)	.0008 (13.0)
MANG	.446 (50)	.3092 (48.7)	.3101 (49.5)	.3078 (48.8)	.3068 (43.3)	.2898 (12.9)
CONS	6.97 (517)	7.13 (200)	7.11 (201)	7.11 (196)	7.11 (192)	7.10 (193)
Random Part*						
Level 2:						
cons/cons		.0407	.0392	.0402	.0410	.0409
edun/cons			-.0005	-.0006	-.0007	-.0005
edun/edun			.0001	.0001	.0001	.0001
exp/cons				-.0002	-.0002	-.0002
exp/edun				.00002	-2.5e-6	-6.1e-6
exp/exp				.00002	.00002	.00004
exp2/edun					9.1e-7	7.4e-07
exp2/exp					-1.5e-7	-8e-07
exp2/exp2					1.6e-8	2.9e-08
mang/mang						.0134
Level 1:						
cons/cons	.0853	.0403	.0392	.0388	.0388	.0379
-2 * log(lh)**	5928.3	-5708.7	-6064.5	-6146.8	-6160.9	-6439.3

Note: * Parameters in random part show variance of a variable or covariance between two variables varying at a given level. For example, 'cons/cons' represents the variance of intercept term varying at level two, 'edun/cons' is covariance between the coefficient for years of schooling and intercept, and so on. The parameters, which were found insignificant at the random part such as 'exp2/cons', 'mang/cons', etc. have been excluded.

Definition of variables and notations used in this analysis are presented in Appendix 1.

** Likelihood ratio is used for testing of hypotheses especially for the random part of a model.

One may also argue that employees with the same educational qualification and years of experience receive different wage rate (hourly earnings) among the units of level two. That is an extra year of experience would have a different contribution to employees' earnings in different firms. This suggests that the slope of earnings-experience profiles varies from one firm to another. To study whether or not there exists such a variation we consider the coefficient for years of experience and experience squared as random coefficients (i.e., Models 4 and 5, Table 6.2). The results show that there is enough evidence to reject the null hypothesis assuming that the contribution of years of experience on earnings is the same across firms.

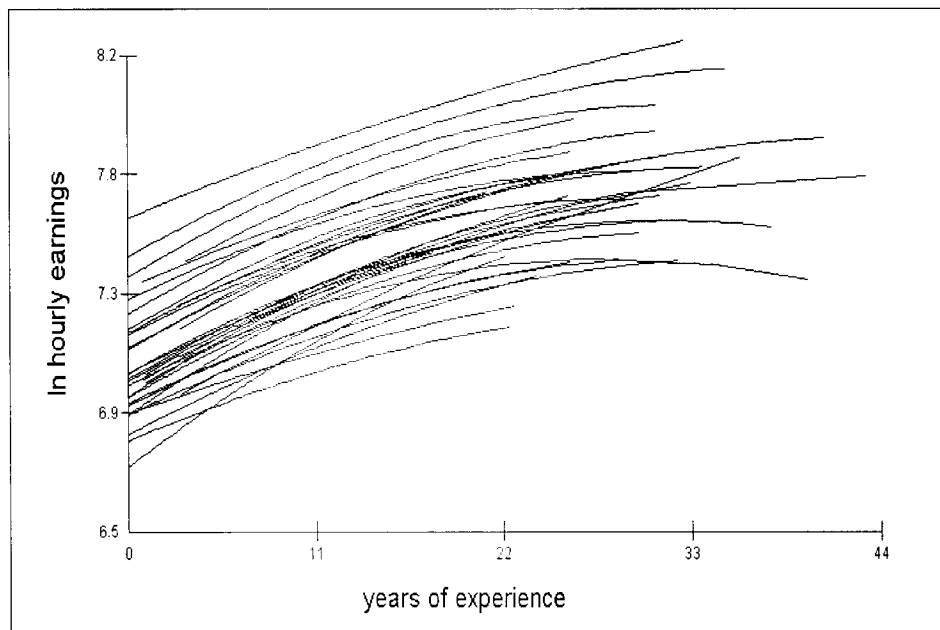
Finally, the variation of contribution of managerial position (MANG) on earnings is another issue, which is worth investigating. To deal with this issue, we consider the coefficient for managerial job-title as a random coefficient. This would help to examine the question whether there is enough evidence to support the hypothesis of inter-firm wage-rate differentials for managers, holding other qualifications constant. The results of earnings function or Model 6, Table 6.2 show that there is indeed evidence to accept the hypothesis that managers receive different wage rate in the selected firms. That is, due to considering the coefficient of management as a varying one, likelihood ratio decreases dramatically (from -6160.9 to -6439.3). Therefore, this indicates that the coefficient for managerial position like the coefficients of other human capital variables varies across the firms.

The results of runs of the basic earnings function presented in Table 6.2, thus, provide evidence that the selected coefficients vary across the level 2 units. Figure 6.3 shows the random or varying relationship between experience and earnings. As can be seen, the relationship is not the same among the firms; employees in different firms *did*

receive different wages and salaries at the start of their working lives and investment through experience was rewarded differently across the firms.

So far, however, we have viewed such variations as due to chance and randomness. In the following section we attempt to extend the basic earnings function by including some firm level variables. The estimates of the extended earnings function, using both the OLS and multilevel techniques, enable us to examine the effect of random or varying coefficient structure on testing of hypotheses.

Figure 6.3: Estimated Earnings-Experience Profiles (varying intercepts and slopes across firms)



Note: The earnings-experience profiles are drawn based on the estimated earnings function 6 of Table 6.2.

6.4 Reliability of Hypothesis Testing

As mentioned earlier, under a varying coefficient situation and hierarchical structure, applying classical regression analysis (OLS), which is based on a single-level

method and an assumption that residuals across observations (i.e. employees) are uncorrelated, will produce unreliable results for testing of hypotheses. In such circumstances, although it is argued that the estimates of the regression parameters are still unbiased, the estimates of the variances are biased. That is we would be underestimating the true variance of the OLS estimators, so this affects the testing of hypotheses.⁶

To study the effect of underestimating variance on *t*-statistics, we run earnings functions under a varying coefficient structure. As presented in Table 6.2, a *t*-statistic, as expected, reduces while its coefficient is considered as varying coefficient. For example, in Model 2 the intercept is considered as a varying coefficient. Its *t*-statistic, in turn, reduces from 495 to 200. In Model 6 the coefficient for management is also examined as a varying or random coefficient and its *t* statistic reduces from 43.3 to 12.9, consequently.

However, the coefficients for human capital variables included in Model 1, Table 6.2, assumed as random coefficients are still very significant. In that respect, it should be mentioned that earnings functions, presented in Table 6.2, do not include all explanatory variables. Including all relevant variables in an earnings function would provide a better base to study the effect of varying structure on testing of hypotheses.

We, therefore, extend the earnings function (6.1) by including firm characteristics and some interaction variables for the interaction between individual and firm characteristics on earnings. Table 6.3 shows the results of the estimated earnings functions. The first column of the table presents an earnings function estimated by using

⁶ Theoretical illustration in that respect is provided in chapter 3.

OLS. All coefficients of Model 1, except the interaction between years of experience and size (“XSIZE”) and between years of experience and geographical location (“XLOCN”), are highly significant. When the intercept is considered to vary randomly across all firms its t statistic dramatically reduces (see Model 2 using multilevel technique in comparison with Model 1). Besides, under this situation some other explanatory variables, such as size, geographical location, and economic sector, are not statistically significant any longer. The sign of some variables also changes due to applying the varying structure. For instance, the interaction between years of schooling and size of firm in the estimated earnings function or Model 1, applying OLS, positively affects earnings while in earnings function 2, incorporating the cluster effects influencing intercept, the situation is reversed. The same situation is held for the interaction between years of experience and economic sector.

The results of unreliability of hypothesis testing are getting worse when we incorporate the cluster effects in the coefficients of the main human capital variables employed. In Model 3, Table 6.3, the coefficients for schooling and experience are also considered as random parameters varying across firms. As a result, their t statistics shrink dramatically and, besides the coefficients which are not significant in Model 2, the coefficients of the interaction between years of experience and economic sector (“XSCTR”), years of schooling and size (“SSIZE”) and years of experience and geographical location (“SLOCN”) become insignificant.

In sum, the above consideration provides evidence to support the hypothesis that there exists a hierarchical structure in data used and this structure affects both intercept and slopes. To achieve reliable and efficient estimates under this hierarchical structure, therefore, the application of multilevel analysis is necessary. Moreover, multilevel

analysis methodology enables us to decompose the error term into two or more elements. This decomposition in turn provides valuable information, for example, regarding the proportion of firm characteristics on earnings differentials as well as that of individuals. It also helps a researcher to study the real determinants of earnings accompanied with new aspects of human capital analysis of earnings such as the externalities attributed to the stock of human capital in each firm. The following section deals with a detailed analysis and the advantages of employing a multilevel analysis of earnings function in the context of human capital theory.

Table 6.3: Estimated Effects of Employee and Firm Characteristics on Earnings using both OLS and Multilevel Methodologies

Variables	Model 1		Model 2		Model 3	
	β	<i>t stat.</i>	β	<i>t stat.</i>	β	<i>t stat.</i>
EDUN	-0.0087	-3.6	-0.0147	-7.6	-0.0113	-2.6
EDUN2	.0015	12.5	.0022	23.5	.0020	21.7
EXP	.0283	21.8	.0210	19.1	.0184	8.4
EXP2	-0.0006	-17.7	-0.0005	-16.0	-0.0004	-15.5
SX	.0005	6.3	.0007	12.1	.0009	13.7
MANG	.4051	49.8	.3070	48.4	.3076	48.5
SIZE	.00016	1.8	.0001	1.1	.0001	1.4
LOCN	.1736	12.2	.1048	1.3	.1023	1.2
SCTR	.1730	9.6	.0010	0.1	.0075	0.1
SSIZE	2.6e-06	3.4	-2.7e-06	-4.3	-4.7e-06	-1.6
XSIZE	-1.5e-7	-0.4	-1.0e-07	-0.3	5.6e-07	0.4
SLOCN	-0.0059	-4.5	-0.0065	-5.9	-0.0069	-1.6
XLOCN	-0.00018	-0.3	-0.0007	-1.2	.0011	0.5
SSCTR	.0155	10.7	.01197	10.6	.0110	2.3
XSCTR	-0.0033	-4.2	.0021	3.5	.0015	0.7
CONS	6.9	401	7.01	92.4	6.99	87.4
Random Part:						
Level 1:						
cons/cons	.0685		.0399		.0388	
Level 2:						
cons/cons			.0363		.0370	
edun/cons					-0.0004	
edun/edun					.00008	
exp/cons					-0.0003	
exp/edun					.00002	
exp/exp					.00002	
-2 * log(lh)	2469.9		-5848.9		-6160.8	

Note: The shaded coefficients are not significant at 10 percent level.

6.5 Multilevel Analysis of Earnings

So far, we have examined the question whether data used in this study are dominated by a hierarchical structure. We have provided evidence that there exists a hierarchical organisation and this structure affects the testing of hypotheses and in turn the results of the analysis. The results of the experiment suggest that the cluster effects also influence the coefficients of the main explanatory variables, which lead to a situation where such coefficients should be recognised as random ones varying across firms. In this section, attempts are made to study whether the coefficients of years of schooling and years of experience are affected by hierarchical structure at level 1. We also examine the advantages of the application of multilevel methodology through conducting a multilevel analysis of earnings in the context of human capital theory.

As presented above, the results of the simple multilevel model 2 of Table 6.1 show that earnings differentials are ascribable into two parts: employee and firm parts. At first, we attempted to evaluate the significance of employee variables. As discussed above, including these variables substantially reduces the variance of error terms of both first and second level. The variance of first level reduces by 42 percent and of level 2 by 35 percent (comparing the variance of error terms of Model 2, Table 6.2, with those of Model 2, Table 6.1). This indicates that the employee variables explain a significant proportion of earnings variation. The coefficient of each variable has a large t statistic demonstrating a high level of significance. All variables, therefore, are consistent with human capital theory and also with most of other empirical studies.

Then, we tried to study whether the hierarchical structure affects the coefficients of main human capital variables. In other words, there was also an interest to investigate whether investments in human capital are rewarded differently among different firms.

Models 3 to 6 of Table 6.2 show that, for example, an additional year of schooling is rewarded differently in different firms, and a similar situation is held for the cases of experience and management. The coefficients of the main human capital variables (years of schooling, years of experience, years of experience squared, and management) vary across the firms. This varying structure, as stated in chapter 3, is consistent with the main argument that a hierarchical structure dominates most individuals' earnings opportunities.

Considering the coefficients of years of schooling and years of experience as random coefficients at level 1 is another important issue, which merits further investigation. The results can provide two important implications; one a statistical point and the other an issue of human capital theory.

As stated at the beginning of this chapter, the conventional OLS analysis assumes that the error terms of an estimated function have a constant variance across all observations. Examination of the question whether the coefficients of independent variables vary across level 1 units can provide evidence for or against this assumption. Earnings functions were run for that purpose and Table 6.4 shows the results. In Model 2, the coefficient of years of schooling is assumed as a varying parameter and in Model 3 the coefficient of both years of schooling and experience are assumed to vary at level 1. The results indicate that the coefficients should be considered as random or varying parameters. Statistically, this varying structure, in fact, relaxes the assumption of constant variance. In other words, the variance of error term at level 1 varies with years of schooling and years of experience, as Equation (6.2) below depicts.

$$\sigma_1^2 = f(e_{0ij}, e_{sj} S_{ij}, e_{xij} X_{ij}) \quad (6.2)$$

where e_{0ij} is error term and the effect of omitted variables at level 1 and e_{sij} and e_{xij} represent the extent to which the effect of schooling and experience of individual i , respectively, depart from the average contribution of schooling and experience to earnings in firm j . Unlike the OLS techniques, in the multilevel methods, therefore, it is assumed that e_{sij} and e_{xij} are non-zero. The rejection of constant variance raises the problem of heteroscedasticity that in turn affect the issue of hypothesis testing elaborated earlier.

Table 6.4: Estimated Effects of Employee Variables on Earnings when Coefficients of Years of Schooling and Years of Experience varying across level 1 Units

	Model 1		Model 2		Model 3	
	Coeff.	Tst.	Coeff.	Tst.	Coeff.	Tst.
Fixed Part:						
CONS	7.103	193.3	7.078	205.0	7.075	208.2
EDUN	-0.0162	-6.4	-0.0042	-1.7	-0.0037	-1.5
EDUN2	0.0020	21.6	0.0011	11.2	0.0011	11.2
EXP	0.0204	12.0	0.02154	23.7	0.0219	17.9
EXP2	-0.0004	-8.9	-0.0005	-13.9	-0.0005	-11.9
SX	0.00083	13.1	0.0007	10.6	0.0007	10.2
MANG	0.2897	12.9	0.2599	11.9	0.2615	11.6
Random Part:						
Level 2:						
cons/cons	0.0410		0.0376		0.0361	
edun/cons	-0.0006		-3.5E-04		-0.0004	
edun/edun	1.0E-04		0.0001		1.1E-04	
exp/cons	-0.00023		-2.2E-04		-0.0001	
exp/exp	4.0E-05		2.2E-06		1.1E-05	
exp2/edun	5.8E-07		7.5E-07		7.8E-07	
exp2/exp	-8.2E-07		1.1E-07		-1.1E-07	
exp2/exp2	3.0E-08		1.5E-08		1.5E-08	
mang/mang	0.01339		0.01133		0.01216	
Level 1:						
cons/cons	0.03792		0.0195		0.023	
edun/cons			-0.0011		-0.0011	
edun/edun			0.0006		0.0006	
exp/cons					-0.0009	
exp/edun					3.0E-05	
exp/exp					7.6E-05	
-2 * log(lh)	-6439.4		-9404		-9778.1	

The variation of the effect of schooling and experience on earnings, in the context of human capital theory, can be considered in the way that each individual has received different pecuniary benefit from his investments through schooling and experience, given years of schooling and years of experience constant. These differences can be attributed partly to the quality of schooling and experience. The estimates of the random part associated with level 1 of Models 2 and 3 enable us to evaluate the standard deviation of the variation of schooling and experience coefficients. For example, based on the estimates of Model 3, Table 6.4, the standard deviation of years of schooling and years of experience are 0.0245 and 0.0087, respectively. These figures suggest that an additional year of schooling for an employee with high quality of schooling may increase hourly earnings about 0.0245 more than the average estimate of years of schooling in a firm. In other words, the schooling effect for 95% of employees clustered within firm j will lie between:

$$\beta_{sij} = \beta_{s0j} \pm 2(0.0245) \quad (6.3)$$

where β_{s0j} is average effect of years of schooling on earnings in firm j . Moreover, dispersion from the average estimate is higher for the estimated coefficient of schooling than that of experience.

6.6 Firm Characteristics and Earnings differentials

It has been demonstrated above that the earnings functions estimated are dominated by a varying structure. This structure affects both intercept and the slopes of an earnings function. It was assumed, so far, that the variation of the coefficients for the human capital variables of an employee clustered in a firm is derived from chance and randomness. In this section, we examine the relaxation of this assumption. That is,

attempts are made to study whether firm characteristics, employed in this study, account for earnings variation attributed to firm level. For that purpose, firstly, an attempt is made to explain the variation in intercept through including firm level variables. In that respect, two categories of variables are distinguished: conventional firm variables such as size, geographical location, and industry and contextual firm variables such as average stock of human capital and average hours of work in each firm. Secondly, we investigate whether variation in the coefficient of years of schooling can be explained by the firm level variables. Finally, we examine the question whether the firm variables account for the dispersion of the estimated coefficient for years of experience from its average.

Table 6.5 shows the results of runs of earnings functions for the purpose of evaluating the effects of firm variables on earnings. Model 2 presents the results of the examination of effects of first category of firm variables on earnings. All coefficients of size, geographical location, and economic sector or industry have positive sign indicating that the variables affect employees' earnings positively. It could be said that employees in larger firms could recoup the benefits of their human capital investment more as compared with the situation of small firms. It might also be argued that firms located in big cities would pay more than those located in small cities to an employee, given the same human capital. However, *t* statistics of the coefficients are not big enough to support such hypotheses. In other words, statistically neither size of firms, geographical location nor economic sector accounts for the variation of intercept at firm level.

For the category of contextual variables, on the other hand, the situation is different. That is, including these variables reduce the variance of firm level by more

than 10 percent. This suggests that they can be regarded as important determinants of earnings; an employee working in a firm with one extra unit of human capital stock receives about 0.02 points more than his counterpart who works in a firm with lower stock of human capital. In other words, the intercept or initial earnings for such a person working in firm j is as follows:

$$\beta_{0j} = \beta_{00} + 0.02 \quad (6.4)$$

where β_{00} is the average intercept.

Different firms may have different hours of work. This may affect employee's earnings. For that purpose another contextual variable (average hours of work in each firm) was calculated. Model 3 shows the estimated effect of average hours of work in each firm on earnings. The coefficient for average hours suggests that employees who have to work in a firm with longer hours earn less, hourly. For instance, an employee working in a firm whose hours worked are less than other firms, say by 100 hours, may earn about 0.02 points more than the average, holding other variables constant. t statistics and change of the likelihood ratio of Model 3 in which the contextual variables are included support these hypotheses.

As presented above, the estimates provide evidence of the fact that the coefficients of the main human capital variables employed vary across firms. The main reasons for such variations might be size of firm, geographical location, industry, average hours of work and/or average stock of human capital. At this stage, it is appropriate to examine the question of whether the variables account for the variations of the coefficients for years of schooling and years of experience or such variations are due to randomness and chance, or perhaps there are some other firm level variables that could not be measured.

Table 6.5: Estimated Effects of Firm Characteristics on Intercept variation of Earnings Functions

Variables	Model 1		Model 2		Model 3		Model 3'	
	β_K	<i>t-stat.</i>	β_K	<i>t-stat.</i>	β_K	<i>t-stat.</i>	β_K	<i>t-stat.</i>
Fixed Part:								
EDUN	-.0037	(-1.5)	-.0037	(-1.5)	-.0038	(-1.5)	-.0037	(-1.5)
EDUN2	.0011	(11.2)	.0011	(11.2)	.0011	(11.2)	.0011	(11.1)
EXP	.0219	(17.9)	.0219	(17.3)	.0217	(19.5)	.0218	(19.7)
EXP2	-.0005	(-11.8)	-.0005	(-11.4)	-.0005	(-13.0)	-.0005	(-13.5)
SX	.0007	(10.2)	.0007	(10.2)	.0007	(10.2)	.0007	(10.1)
MANG	.2615	(11.6)	.2614	(11.6)	.2614	(11.6)	.2613	(11.6)
SIZE			.00005	(1.0)	.00004	(1.0)	.00003	(0.8)
LOCN			.0775	(1.1)	-.0030	(-0.1)	-.0079	(-0.1)
SCTR			.0413	(0.5)	-.0502	(-0.7)	-.0419	(-0.7)
AV_S_X*					.0192	(2.4)	.0190	(2.4)
AV_HRS					-.0002	(-5.1)	-.0002	(-5.2)
CONS	7.07	(208)	6.99	(98.2)	7.32	(37)	7.37	(41.8)
Random Part								
	1		2		3			
Level 2:								
cons/cons	.03611		.0338		.0291		.0301	
edun/cons	-.0004		-.0003		-.0008		-.0008	
edun/edun	.00011		.00011		.00011		.00011	
exp/cons	-.00015		-.00016		-.0003		-.0003	
exp/exp	.00001		.00001		.00001		.00001	
exp2/edun	7.8e-7		7.4e-7		8.3e-7		7.9e-7	
exp2/exp	-1.1e-7		-1.7e-7		-2.0e-8		3.1e-8	
exp2/exp2	1.5e-8		1.7e-8		1.1e-8		1.0e-8	
mang/mang	.0122		.0121		.0121		.0122	
Level 1:								
cons/cons	.023		.023		.0232		.0232	
edun/cons	-.0012		-.0012		-.0012		-.0012	
edun/edun	.00055		.00055		.00055		.00055	
exp/cons	-.0009		-.0009		-.0009		-.0009	
exp/edun	.00003		.00003		.00003		.00003	
exp/exp	.00008		.00008		.00008		.00008	
$-2 * \log(lh)$	-9778.1		-9780.4		-9799.7		-9799.6	

Note: * It should be noted that in the estimated earnings functions presented in this table and subsequent tables of chapter 6 it is assumed that average years of schooling in each firm increase earnings of employees as much as average years of experience. To calculate average stock of human capital in each firm, we used $\Sigma(EDUN_{ij} + EXP_{ij})/n_j$; where n_j is the number of employees in firm j . This assumption may not necessarily be a satisfactory assumption for different sets of data and, therefore, the assumption should be supported by empirical evidence. One reasonable way is to use weighted average stock of human capital. For this purpose, the weighted average stock of human capital can be calculated, for example, through using $\Sigma((\beta_{avs} / \beta_{avx}) * EDUN_{ij} + EXP_{ij})/n_j$; where β_{avs} and β_{avx} are the contribution of average years of schooling and years of experience to earnings, respectively. By doing this, we found that the results are similar (Model 3 in comparison with Model 3'). Since the issue of externality effect of human capital density is of interest to economists, it would be interesting to see if there are more appropriate ways of estimating average stock of human capital in each firm, which merits further investigation. The results of experiments using a variety of methods of weighting the average stock of human capital are presented in Appendix 1, Table A2.

The results of runs are presented in Table 6.6. Model 1 incorporates the interactions between years of schooling and the contextual firm variables (“sav_s_x” and “sav_hrs”) on earnings. The estimates of the model show that only average hours of work can partly explain the variation of the coefficient of years of schooling across the firms. In the same manner, attempts were made to explain the variation in the coefficient of years of experience by including the interactions between years of experience and the contextual variables (Model 2). None of the variables could provide an explanation in this regard and their t statistics are all insignificant. However, average hours of work in each firm seems to have a negative effect on the variation. The average stock of human capital in a firm may positively influence the variation of the effect of experience on earnings. This may be viewed in the way that an employee working in a firm with larger stock of human capital has a better opportunity to accumulate his human capital through on-the-job learning. The greater volumes of human capital accumulation through learning imply the steeper earnings profiles over years of experience in firm j .

Through running earnings function or Model 3, which includes the interactions between years of schooling and the conventional firm variables, we test the hypothesis that the conventional firm variables account for the variation of the coefficient for years of schooling. As the results of Model 3 show, none of the variables has a statistically significant effect.

We also ran earnings function 4 of Table 6.6 to evaluate the effect of these conventional variables on the variation of experience coefficient. Like the case of schooling coefficient, they too are not statistically significant.

Overall, Model 4 presents the estimated effect of determinants of earnings using an extended form of Mincerian earnings function through applying a multilevel methodology. The human capital variables at the employee level of analysis have a significant contribution to earnings differentials. The results are consistent with human capital theory and indicate that individuals receive pecuniary benefits from their human capital (investments). Each human capital variable has a different contribution to earnings. In the following section the marginal effect of each variable on earnings is presented, separately.

6.7 Marginal Effect of Human Capital Variables on Earnings

The results of the multilevel analysis, like that presented in chapter 5, show that years of schooling contributes to increasing earnings at an increasing rate.⁷ The marginal effect of schooling also increases with years of experience. For example, an additional year of schooling increases hourly earnings, for an employee with 12 years of schooling and with 20 years of experience, by 4.7 percent, based on the estimates of Model 4 of Table 6.6. The equivalent figure for an employee with 16 years of schooling (a higher education degree) and with 30 years of experience is 6.3 percent.

The random part of the multilevel models gives the extent to which the random parameters depart from their overall average. In the case of the coefficient for schooling, the estimate suggests that contribution of schooling to earnings in approximately 95% of firms will lie between

⁷ It seems the increasing contribution of schooling with levels of education to earnings has become a widespread phenomenon since early 1980s, as Carnoy states (1997: 489-90).

$$\beta_{s0} \pm 2(0.0088)$$

assuming that the firms' coefficient of schooling are normally distributed.

The random part associated with schooling effect provides another important piece of information. The negative estimate for covariance between intercept and schooling coefficient indicates the tendency that firms with higher intercepts have smaller slopes for schooling variable. This provides empirical support for the idea that individuals may accept lower levels of earnings for a better prospect of learning opportunity to enhance earnings later. The estimates of random part of the model enable us to estimate the correlation between intercepts and slopes. For example, the estimated correlation between schooling coefficient and intercept is -0.40 , which is consistent with the above-mentioned argument.

Years of experience also increases earnings but do so at a decreasing rate. The experience effect, however, increases with years of schooling:

$$\partial(\ln y) / \partial x = \beta_{xj} - 2\beta_{xx}x + \beta_{sx}s \quad (6.5)$$

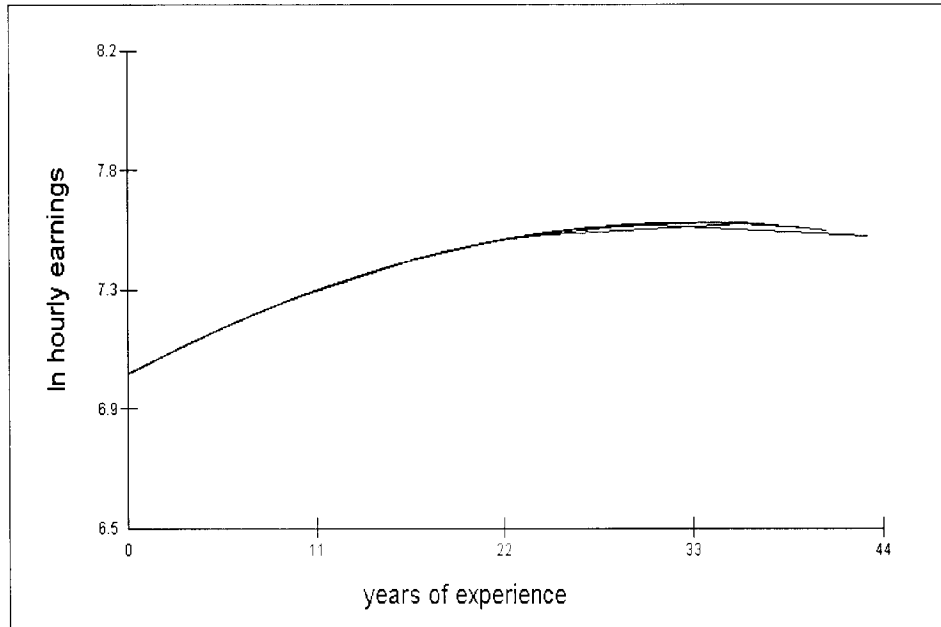
Equation (6.5) provides the marginal effect of experience on earnings in firm j . The equivalent figure for all employees will be given by:

$$\partial(\ln y) / \partial x = \beta_x - 2\beta_{xx}x + \beta_{sx}s \quad (6.6)$$

Using the estimates of Model 4, it can be said that an extra year of experience for an employee with 12 years of schooling who is at the beginning of his working life about 3 percent, on average, contributes to earnings. The corresponding figure for an individual with 16 years of schooling and with 10 years of experience is 2.3 percent. Figure 6.4 shows an estimated earnings-experience profile for all employees, which

depicts the relationship between experience and earnings after controlling for other variables and cluster effects.

Figure 6.4: An Estimated Earnings-Experience Profile for all Employees



Note: The earnings-experience profile is drawn based on the estimated earnings function 4 of Table 6.6.

As elaborated earlier, the effect of experience on earnings varies across firms. Assuming that the firms' coefficients of experience are normally distributed, the estimates suggest that the effects of experience and experience squared on earnings in approximately 95% of firms will lie between:

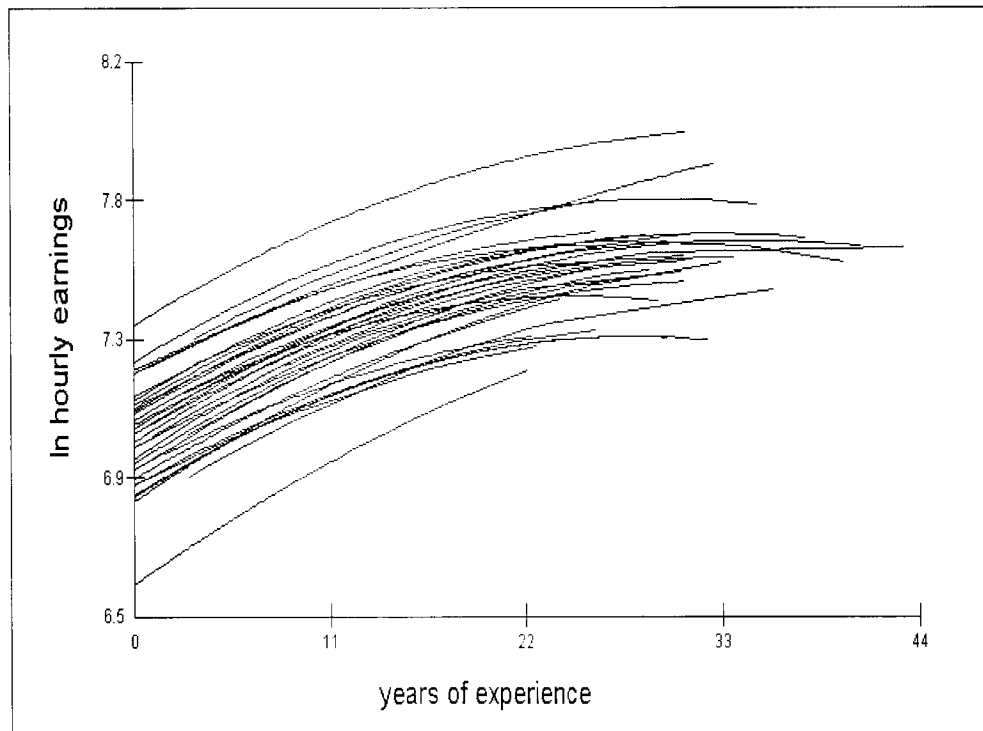
$$\beta_{xj} = \beta_{x0} \pm 2(0.0041)$$

$$\beta_{xxj} = \beta_{xx0} \pm 2(0.00012)$$

Similar to the schooling coefficient, the covariance associated with intercept and experience variable at random part of level 2 indicates that firms with steeper earnings-experience profiles have lower intercepts and vice versa. This may also be viewed in the

way that firms with lower starting wages and salaries are likely to provide better learning opportunities and in turn higher growth rates of earnings with experience. Figure 6.5 shows such a varying relationship.

Figure 6.5: A Separate Estimated Earnings-Experience Profile for each Firm (varying intercepts and slopes across firms)



Note: The earnings-experience profiles are drawn based on the estimated earnings function 4 of Table 6.6.

By plotting earnings-experience and earnings-age profiles, Fig 5.1 and Fig. 5.2 chapter 5, it has been shown that the gap between the profiles increases with experience (or age). The interaction between years of schooling and years of experience was entered in the extended earnings function to account for such a phenomenon. The estimate of this variable (derived from Model 4 of Table 6.6) shows that the interaction variable has a positive effect on earnings indicating that the contribution of schooling (experience) to earnings increases with years of experience (schooling). These findings

are, in fact, consistent with the notion that more educated people can invest more through on-the-job learning.

As the case of OLS analysis, the multilevel analysis provides evidence that individuals who have managerial jobs earn more than those who do not have managerial jobs. However, as argued before, the job seniority is partly because of more education and experience and these additional earnings from the job seniority (up to 80 percent)⁸ can be attributed to the option value of education and experience. Moreover, managerial jobs may also provide a better opportunity for learning on the job, and potential managers might need to acquire specific skills. Such investments with extra responsibilities, which managers usually have, may also provide an explanation for earnings differentials attributed to management.

The multilevel estimate of management to (log) earnings differentials is 0.26. It indicates that being a manager increases hourly earnings by 26 percent on average. However, the contribution of management variable varies across firms. The standard deviation of the coefficient of the management derived from the random part of Model 4, Table 6.6, is 0.1085. This suggests that the effect of management on earnings in approximately 95% of firms will lie between $0.26 \pm 2(0.108)$, assuming that the firms' coefficients of management are normally distributed.

As presented above, firm variables are classified into the two categories of conventional and contextual variables. Findings of the extended earnings function, Model 4, suggest that contextual variables alone account for, in part, earnings differentials attributed to firm level. The effects of these variables are distinguished into

⁸ Based on the logistic estimation presented in chapter 5.

two parts: the effects on intercept and on slopes. The inclusion of average stock of human capital in a firm, as one of main contextual variables, in an earnings function provides interesting results.

The average stock of human capital in each firm, which is directly affected by worker characteristics, mainly influences the intercepts and, in a much lesser extent, the coefficient of years of experience. The results of earnings function 4 presented in Table 6.6 show that one extra unit of the variable in a firm contributes some 2 percent to earnings of employees working in the firm, holding other variables constant. That is, an employee with a given human capital would earn more in a firm that has a higher average accumulation of human capital than in a firm with otherwise situation. This effect in fact echoes the effect of human capital density on earnings and is attributable, in part, to externalities due to human capital density. Such externality effects would provide a signal to attract better and highly qualified workers into better and more productive firms.

In sum, the results of the multilevel analysis highlight the key point that human capital variables are main determinants of earnings. Institutional factors that were considered as the conventional firm level variables were found to be insignificant when the cluster effects were incorporated into the analysis. However, through conducting an OLS analysis, most of the firm variables were found to be important and significant determinants of earnings. The empirical analyses, therefore, clearly show that employing the classic OLS technique, when data are dominated by a hierarchical structure, provides unreliable estimates for the testing of hypotheses. The findings also tend to support the claim of human capital theory in comparison with, for example, institutional hypotheses.

Table 6.6: Extended Earnings Functions; Estimated Effects of Employee and Firm Characteristics on Earnings

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β_k	<i>T st.</i>	β_k	<i>T st.</i>	β_k	<i>T st.</i>	β_k	<i>T st.</i>	β_k	<i>T st.</i>
CONS	7.053	30.8	6.969	25.7	7.026	28.0	7.041	27.7	6.816	26.2
EDUN	0.0264	2.2	0.0288	2.2	0.0237	2.4	0.0225	2.2	0.0190	2.0
EDUN2	0.0011	11.1	0.0011	11.1	0.0011	11.1	0.0011	11.1	0.0011	11.4
EXP	0.0216	18.6	0.0245	3.5	0.0210	3.2	0.0211	3.1	0.0211	3.3
EXP2	-0.0005	-14.0	-0.0005	-14.5	-0.0005	-11.6	-0.0005	-11.6	-0.0003	-7.4
SX	0.00074	10.2	0.0007	10.1	0.0007	10.2	0.0007	10.1	0.0007	9.2
MANG	0.2607	11.6	0.2604	11.7	0.2596	11.7	0.2599	11.7	0.2576	11.6
SIZE	4.4E-05	1.1	4.5E-05	1.2	8.1E-05	1.9	7.3E-05	1.4	7.8E-05	1.5
LOCN	0.00608	0.1	0.00404	0.1	0.0260	0.4	0.0045	0.1	0.0029	0.0
SCTR_D	-0.0592	-0.9	0.05975	0.9	-0.0801	-1.1	-0.0672	-0.8	-0.0826	-0.9
AV_S_X	0.0246	2.8	0.02257	2.2	0.0186	2.1	0.0190	2.1	0.0198	2.1
AV_HRS	-0.0002	-3.3	-0.0001	-2.0	-0.0001	-2.1	-0.0001	-2.1	-0.0001	-2.3
SAV_S_X	-0.0007	-1.4	-0.0006	-1.1						
SAV_HRS	-6.5E-06	-2.6	-8.0E-06	-3.0	-8.6E-06	-2.7	-8.4E-06	-2.6	-7.4E-06	-2.5
XAV_S_X			1.3E-04	0.5	0.0003	1.4	0.0003	1.0	-4.3E-05	-0.1
XAV_HRS			-1.9E-06	-1.3	-1.9E-06	-1.4	-1.9E-06	-1.3	-1.3E-06	-1.0
S_SIZE					-2.9E-06	-1.3	-2.7E-06	-1.0	-3.6E-06	-1.4
S_LOCN					-0.0046	-1.3	-0.0036	-0.9	-0.0034	-0.9
SSCTR					0.0050	1.2	0.0044	1.0	0.0058	1.3
XSIZE							3.2E-07	0.3	-7.8E-07	-0.7
X_LOCN							0.0011	0.6	0.00131	0.7
XSCTR							-0.0007	-0.3	0.00028	0.1
AGE									0.0141	9.7
AGE2									-0.0002	-10.3
Level 2:										
cons/cons	0.0288		0.0278		0.02692		0.02707		0.0281	
edun/cons	-0.0006		-0.0006		-0.00058		-0.00057		-0.0006	
edun/edun	8.7E-05		8.4E-05		7.8E-05		7.8E-05		7.6E-05	
exp/cons	-0.00036		-0.0003		-0.0003		-0.0003		-0.0003	
exp/exp	1.1E-05		1.0E-05		1.9E-05		1.7E-05		6.9E-06	
exp2/edun	8.2E-07		7.6E-07		6.2E-07		6.2E-07		6.6E-07	
exp2/exp					-3.2E-07		-2.7E-07			
exp2/exp2	8.3E-09		6.8E-09		1.5E-08		1.4E-08		1.1E-08	
mang/mang	0.01204		0.01192		0.01177		0.01178		0.0118	
Level 1:										
cons/cons	0.0232		0.0232		0.0231		0.0231		0.0224	
edun/cons	-0.0012		-0.0012		-0.0012		-0.0012		-0.0011	
edun/edun	0.0006		0.0006		0.0005		0.0005		0.0005	
exp/cons	-0.0009		-0.0009		-0.0009		-0.0009		-0.0008	
exp/edun	3.0E-05		3.0E-05		3.0E-05		3.0E-05		2.8E-05	
exp/exp	7.7E-05		7.7E-05		7.7E-05		7.7E-05		7.5E-05	
-2* log(lh)	-9804.9		-9806.9		-9810.8		-9811.2		-9920.7	

6.8 Actual and Potential Experience and Earnings

After the pioneering work of Mincer in 1974, most empirical human capital analyses of earnings have employed estimated or potential years of experience as a proxy for investment in human capital through on-the-job training. In this study, however, we use actual years of experience. It is believed that the estimated years of experience does not provide an unbiased estimate of the contribution of on-the-job learning/training to earnings.⁹ To investigate this hypothesis, earnings functions were run and the results are presented in Table 6.7. In Models 1 and 2, actual years of experience are added to account for earnings variation from on-the-job learning and in Models 3 and 4 estimated years of experience. Model 1 and 3 are identical for the purpose of comparison. The marginal effect of the estimated years of experience is much more than that of actual experience. Therefore, using potential experience leads to overestimating the effect of experience on earnings. This overestimation, based on the findings of this study, increases with years of experience and decreases with years of schooling.

To have a more detailed analysis, both actual and potential years of experience are added in Model 4. The coefficients of estimated years of experience are reduced dramatically. Moreover, the coefficients of actual years of experience are larger than those of estimated years of experience.¹⁰ These findings suggest that the growth of hourly earnings with potential experience in large part due to growth of earnings with

⁹ A study by Arabsheibani (1996:10) highlights the issue for the case of Egypt.

¹⁰ Using data from the Michigan Panel Study on Income Dynamics, Hanushek and Quigly (1978:73) report the same findings.

actual experience. The rest can be attributed to other kinds of post-school investment and maturity with age that are not captured by actual experience.

Table 6.7: Estimated Effects of Actual and Estimated Years of Experience on Earnings

	1		2		3		4	
	β_k	<i>T st.</i>	β_k	<i>T st.</i>	β_k	<i>T st.</i>	β_k	<i>T st.</i>
Fixed Part:								
CONS	7.042	31.8	6.819	31.0	6.567	28.1	7.082	33.0
EDUN	0.0155	1.7	0.0134	1.5	0.0239	2.4	0.0015	0.2
EDUN2	0.0011	11.1	0.0012	11.5	0.0016	10.8	0.0020	13.5
EXPE*					0.0269	18.8	0.0062	3.7
EXPE2					-0.0003	-20.3	-0.0001	-6.2
SX**	0.0007	10.3	0.0007	9.4	0.0003	3.3	0.0006	6.5
MANG	0.2601	11.6	0.2578	11.5	0.2711	11.9	0.2466	10.8
AV_S_X	0.0231	3.0	0.0228	3.0	0.0294	3.7	0.0201	2.7
AV_HRS	-0.0001	-2.8	-0.0002	-3.0	-0.0001	-2.4	-0.0002	-3.3
SAV_HRS	-7.2E-06	-2.2	-6.7E-06	-2.1	-8.0E-06	-2.4	-6.8E-06	-2.1
AGE			0.0143	9.9				
AGE2			-0.0002	-10.5				
EXP	0.0217	18.4	0.0164	12.7			0.0203	21.6
EXP2	-0.0005	-17.3	-0.0003	-8.8			-0.0003	-9.6
Random Part:								
Level 2:								
cons/cons	0.0278		0.0278		0.0412		0.0464	
edun/cons	-0.0007		-0.0006		-0.0011		-0.0013	
edun/edun	8.7E-05		8.5E-05		0.0001		0.0001	
exp/cons	-0.0003		-0.0003		-0.0003		-0.0004	
exp/edun	1.1E-05		1.4E-05		1.2E-05		1.6E-05	
exp/exp	1.3E-05		1.3E-05		7.2E-06		7.3E-06	
mang/mang	0.0122		0.0120		0.0125		0.0126	
Level 1:								
cons/cons	0.0231		0.0223		0.0634		0.0546	
edun/cons	-0.0011		-0.0011		-0.0040		-0.0037	
edun/edun	0.0006		0.0005		0.0007		0.0007	
exp/cons	-0.0009		-0.0008		-0.0014		-0.0012	
exp/edun	2.9E-05		2.7E-05		0.0001		9.7E-05	
exp/exp	7.6E-05		7.5E-05		4.0E-05		3.6E-05	
-2* log(ll)	-9784		-9897.8		-8878.3		-9934.7	

Note: * “EXPE” stands for potential years of experience derived from: “AGE – S – 6”.

** “SX” in Model 1 and 2 is the product of “edun”*“exp” and in Model 3 and 4 of “edun”*“expe”.

As argued in chapter 3, the assumption that individuals start their working lives immediately after graduation, especially for countries experiencing high rate of unemployment, is not a plausible assumption. However, during such periods, individuals may have other opportunities to invest in themselves. For instance, they may attend special courses during unemployment period. Besides, maturity with age may also create variation in earnings. All these factors, accompanied with actual experience, make the earnings-age profiles steeper than earnings-experience profiles, as demonstrated in chapter 5. This implies that actual experience does not account for all earnings differentials among individuals, given the years of schooling constant. The profiles, however, do not enable us to evaluate the extent to which experience, in comparison with other post-school investments, contributes to earnings. With respect to this aspect, Model 2 of Table 6.7, including age and age squared, was run. The coefficients of age are statistically significant, indicating that age also is an important determinant of earnings. However, the coefficients of experience (i.e. the marginal effect of experience) are larger than those of age. (Model 5 of Table 6.6 presents the same findings.) This suggests that larger volumes of human capital after graduation are accumulated through experience.

6.9 Summary and Conclusion

To investigate the relationship between education, experience and earnings in the manufacturing sector of Iran's economy, we have conducted an empirical analysis based on 15755 observations (employees) at level 1 and 35 observations (firms) at level 2. It has been found that the amount of education and experience are significantly associated with earnings of the employees. The association between higher education and

experience and higher earnings tend to support the hypothesis that spending on human beings is an investment, which is rewarded with pecuniary benefits in the labour market.

It was found that years of schooling increase earnings and do so at an increasing rate. Such additional earnings from schooling can be ascribed to extra human capital accumulation at higher levels of education and the fact that investment acquired through higher levels of education is more specific and more relevant to a job.

Moreover, the results of multilevel analysis of earnings differentials showed that data used are dominated by a hierarchical structure. As demonstrated in section 6.4, in a hierarchical structure, the OLS estimates are not efficient and employing an earnings function for overall observations under an OLS methodology, which ignores the effects of the structure on the estimates, misleads us in testing of hypotheses. In Table 6.3, Model 1, it was shown that when we employ an OLS method most coefficients for firm variables employed in this study (i.e., size of firm, geographical location, and economic sector variables) and interaction between these variables and years of schooling and years of experience significantly affect the earnings of employees. However, once the coefficients for years of schooling and years of experience are considered as random coefficients varying across firms, as in Model 3, all the variables, except the interaction between years of schooling and size, geographical location and economic sector, changed to become insignificant. That is, in Model 3 employing the multilevel methodology, neither size of firm, geographical location, and economic sector nor their interactions with years of experience can significantly explain earnings differentials across the firms.

Based on the results, it was found that this hierarchical structure also affects the estimated effects of education, experience and management. That is, the coefficients of

human capital variables vary across the units of level 2 (i.e. firms). Attempts were made to explain earnings variation across firms through including firm level variables; that is, the conventional firm variables (i.e., size, geographical location and industry) and contextual firm variables (i.e. average stock of human capital and average hours of work). Unlike the results of the OLS method, none of the conventional variables accounts for earnings variation across firms, which support the argument that the application of OLS techniques in a hierarchical structure lead to incorrect inferences.

The contextual variables can explain, in part, the variation. For example, we found that employees working in a firm with higher proportion of human capital earn more. Such findings can be interpreted as externality effects of human capital density.

Finally, the human capital variables employed remain significant determinants of earnings. This empirical evidence suggests that after eliminating the cluster effects through applying the multilevel technique, the importance of non-human capital variables in earnings determination is weakened, which support the view that human capital theory is a powerful analytical tool in explaining earnings differentials.

The issue of varying effects of education and experience on earnings can be illuminated in two dimensions; the first one can be regarded in such a way that education and experience are more productive in some firms than in others. That is, due to some elements such as human capital density (i.e. higher proportion of human capital in a firm), education and experience may make a greater contribution to increasing earnings than otherwise. Regarding the other dimension, it can be said that in a situation where investments in human capital are more productive, in terms of augmenting earnings, an individual has a stronger opportunity and motivation to invest in himself, especially through experience and (on-the-job) training.

Finally, an attempt was made to examine the assumption that individuals start their working lives immediately after graduation. Our data about actual years of experience enabled us to evaluate the validity of such an assumption. It was found that individuals with different educational levels experienced different (un)employment patterns; the more educated experienced a shorter unemployment period after graduation than the less educated. Consequently, as the findings showed, including the estimated, instead of actual, years of experience in an earnings function would overstate the effect of experience on earnings.

Chapter 7 Education, Earnings and Productivity

7.1 Introduction

In chapters 5 and 6, we presented the results of the analyses applying both OLS and multilevel techniques. It was demonstrated that the main human capital variables (education, experience, and management) account in part for the earnings variation among employees. The analyses enabled us to establish the relation between the human capital variables and earnings and to estimate the extent to which such variables contribute to earnings. However, such findings do not explain *why* human capital variables explain earnings differentials. In this chapter attempts are made to illuminate and to investigate this aspect of human capital theory. First, we discuss some aspects of the debate between human capital theory and screening hypotheses, in general, and the signalling hypothesis in particular. Secondly, the sample of respondents, who were the senior managers of selected companies and responsible for making and implementing wages/salaries, employment policies, and training programmes in their own company, is discussed. Finally, qualitative data collected through interviews are presented and analysed under three separate sections for education, experience, and training. As

demonstrated in the previous chapters, the variables employed in earnings functions account for a large part of the earnings variation among employees. However, another part of earnings differentials remains unexplained, and some observations were found to be outliers. In the next section, using interviews' responses, we shall present explanations for such observations and outliers as well as for the previously unexplained part of earnings differentials. The chapter ends with concluding remarks on the issue of productivity-enhancing role of education.

7.2 Education and Productivity

In chapter 2, relevant issues concerning the theoretical underpinnings of investment in human capital were reviewed. It was demonstrated that human capital theory could provide a theoretical explanation that justifies the investment behaviour of an individual spending on himself. As Cohn and Geske (1990: 34) point out, the basic premise of the human capital approach is that variations in labour income are due, in part, to differences in labour quality in terms of the amount of human capital acquired by the workers. This premise, however, is based on the assumption that investments in human capital improve the productivity of workers, and hence increase earnings through imparting useful knowledge and skills. This assumption has been attacked by critics¹ who have argued that the higher earnings of more educated workers reflects their superior ability, higher social background, etc. rather than specific knowledge and skills

¹ Among others are Arrow (1973), Filtering Theory; Spence (1973), Signalling Theory; and Stiglitz (1973), Screening Hypothesis.

acquired during the educational process. These critics, therefore, are sceptical and doubtful about the productivity-augmenting role of education. In their view education serves mainly as a screening device to select the abler workers.

Spence's signalling view, for example, states that an employer cannot directly observe the productive capabilities of an individual at the time he hires him. Nor will this information necessarily become available to the employer immediately after hiring. What the employer observes, Spence argues, is a plethora of personal data in the form of observable characteristics and attributes (i.e., signals) of the individual, and it is these that must ultimately determine the employer's assessment of the productive capabilities of an applicant. For each set of signals that the employer confronts, he will have an expected marginal product for an individual who has these observable attributes. This determines the wage offered to applicants with those characteristics. Potential employees therefore confront an offered wage schedule whose arguments are signals. These signals are alterable and therefore potentially subject to manipulation by the job applicant. Of course, there may be costs in making these adjustments. Education, for example, is costly and incurs a signalling cost. The individual will invest in education if there is sufficient return as defined by the offered wage schedule. It is postulated in this view that individuals select signals so as to maximise the difference between offered wages and signalling costs. (Spence, 1973)

The *signalling* theory, as mentioned above, views education as a signal that yields useful information to identify individuals with higher expected productivity. That is, the employer, who cannot observe the productive capabilities of a potential employee at the

time of hiring, uses observable characteristics such as education to select more able and productive applicants through offering appropriate wages to the applicants with those characteristics. This process of selection seems to be very cheap for the employer (Wiles, 1974) because the employer does not pay the costs of education. Human capital theory, on the other hand, postulates that education actually *improves* the productive capacity of employees, which is the main reason why employers pay more to the more educated.

For the purpose of our empirical analysis, we illuminate the relationship between investment in human capital and earnings by investigating; first, the existence of a positive relationship between education and earnings, and second the reason why education influences earnings. From the viewpoint of an individual employee it does not matter whether education improves productivity or serves mainly as a screening device to select more able workers. In either case the earnings differentials actually ascribed to education would provide an indication that education and training are good investments.

The other issue, that is how education affects earnings, is in fact the key debate between human capital and screening theorists. This issue concerns the demand for (the services of) human capital. From that aspect, relevant questions emerge; How and why do investments in human capital explain earnings differentials? Why do employers offer higher pay to more highly educated workers? Is it because education makes workers more productive, or because education merely serves as a screening device that identifies the more able and highly motivated young people?

These questions, from the viewpoint of an employer², can be elaborated in two dimensions: the employer's incentives first for paying more to the more educated workers, and second for paying the cost of training their employees. As presented in chapter 2, a variety of approaches have been employed to investigate the first dimension. As has been discussed, such approaches, in which earnings functions were employed, cannot evaluate the validity of human capital theory versus screening hypotheses (and vice versa) in connection with the question why education increases earnings. Especially, if we accept the view that the more educated are paid more because they actually are more productive, there is not a clear cut distinction between human capital theory and screening hypotheses; that is, higher productivity may be due to higher ability, as screening hypotheses predict, or due to education itself, as human capital theory presumes. In both cases a positive correlation between human capital variables and earnings is expected, as demonstrated in the previous chapters. To study the debate and to provide empirical evidence, therefore, other aspects of the relationship between investment in human capital and productivity need to be illuminated. Such aspects are presented in the subsequent sections.

7.3 Qualitative Data and Respondents

As discussed in chapter 3, the main purpose of the analysis in this chapter is to investigate the debate between human capital theory and screening hypotheses by

² This part of the study is confined to employers' viewpoints. The issue of social benefits of education and schooling is another vital aspect, which is beyond the scope of this analysis.

analysing data derived from interviews with employers. In the interviews we asked the respondents to describe how they treat education and other kinds of investment in human capital and how they see the relationship between investment in human capital and earnings/productivity in the actual world. To clarify the issue, we extended the debate from the specific case of education to other kinds of human capital; that is, training and experience for which the screening hypotheses fail to provide any explanation. Moreover, as the results of the quantitative analyses showed, part of the earnings variation among the employees remains unexplained. After running a separate earnings function for each firm using OLS technique, we found some extreme values and outliers. An attempt was also made to collect explanations for such values. In the following sections we attempt to elaborate these issues, using data derived from interviews.

To collect the qualitative data for this study, we interviewed 12 persons who were mainly members of management board, and administrative and financial managers directly involved in making and implementing employment and wage policies in their own companies. Outline details of respondents are presented in Table 7.1. We tried to collect data as much as possible through interview and were able to interview the representatives of 10 firms.³ These firms, which cover some 29 percent of units of level 2 of the quantitative analysis, employ more than 7300 workers (46 percent of all observations at the employee level).

³ Detail about the selection of interviewees is presented in chapter 3.

Table 7.1: Outline details of respondents

Referring Code	Interviewee
I-1	(a) member of management board, and administrative and financial manager; and (b) manager of recruitment department in refrigerator and heater manufacturing company
I-2	member of management board and deputy in car part manufacturing company
I-3	director of paper and cardboard manufacturing firm
I-4	(a) administrative manager, (b) training unit director in medical product manufacturing company
I-5	deputy of chief executive in car part manufacturing company
I-6	member of management board, and administrative and financial manager in distribution company
I-7	director of textile manufacturing company
I-8	Administrative and financial manager in textile manufacturing company
I-9	member of management board and administrative and financial manager in food and chocolate manufacturing company
I-10	director of textile manufacturing company *

Notes: * We could not complete this interview because of time limitation at the first meeting. Another appointment was made for a more detailed discussion of the issues that we were interested in but we could not meet the person to complete the interview.

Appointments were made to interview the representatives of three other firms. We were not able to meet and conduct interviews due to fact that respondents had no time available to be interviewed.

The interviews lasted between 45 minutes and 2 hours. In some cases, one person from a firm was interviewed and in others, where further explanation and discussion were necessary, two people. In some cases we had to see the same person more than once, mainly due to time limitations at the first meeting. We also made appointments with the representatives of three other firms and waited at the places where these interviews were expected to take place; however, as stated earlier, we were not able to conduct these interviews.

In the interviews, the respondents were asked about the situation and importance of the educational qualifications and experience of their (prospective) employees in regard to recruitment, productivity, and earnings. (A copy of the semi-structured questionnaire is provided in Appendix 3.) We asked questions about their training programmes as well. The key purpose of this part of study is to provide evidence regarding the debate between human capital theory and screening hypotheses. In other words, the results of this part of analysis shed light on the question whether investments in human capital contribute to improving the productivity of the employees.⁴ In the following sections, the behaviour of employers concerning different kinds of investment in human capital is elaborated in three sections dealing with education, experience and training. In each section, data derived from the interviews is presented and interpreted.

⁴ Concerning the relationship between investments in human capital and productivity, two dimensions can be recognised: whether there is a positive relation between the investments and productivity and how these investments improve productivity. It is the first dimension that is of interest in this study. However, an attempt is also made to present and to analysis data collected on the other dimension.

7.4 Education

In this section, we shall present the respondents' views about the situation and significance of educational qualifications awarded before recruitment. This should help to elaborate and explain how employers observe and treat educational qualifications, and whether they see education as a screening device or as a productivity-augmenting element. This analysis is followed by a discussion of the investment behaviour of the employers concerning the education of their employees who have already been screened.

Assuming perfect competition in both labour and product markets, Becker, in his theoretical examination (1962, reprinted in: 1993), tries to make a connection between wages and the marginal product of a profit-maximising firm. He argues:

If there were no on-the-job training, wage rate would be given to the firm and would be independent of its actions. A profit-maximising firm would be in equilibrium when marginal products equalled wages, that is, when marginal receipts equalled marginal expenditure. (Becker 1962, reprinted in: 1993:31)

It should be inferred, therefore, that the willingness of the employer to pay more to more educated workers is directly related to the fact that more educated workers should also be more productive, so there would be a positive relation between wages and marginal productivity. That is:

$$W_i = f(VMP_i) \tag{7.1}$$

where W_t and VMP_t are earnings and the value of the marginal products of an employee at time t , respectively. In these circumstances, as Becker remarks, firms would not worry too much about the relation between labour conditions in the present and future, partly because workers would only be hired for one period and partly because wages and marginal products in future periods would be independent of a firm's current behaviour.

In that respect a connection between earnings and educational qualifications of employees can be made, in that educational qualification is usually attained before recruitment at a firm. Therefore, the current wage of an employee should be dependent on his current productivity (i.e., Equation (7.1)). Consequently, an employee with higher education earning more wages (in comparison with an employee with lower education), as observed in previous chapters, should also be more productive.⁵ The question is whether this higher productivity is attributable to the pre-existing ability of employees signalled by higher education, as argued in signalling, filtering and screening hypotheses, or whether it is education that improves the productive capacity of employees. In the latter case the higher productivity is partly attributed to education, human capital theory.

Screening hypotheses consider education as a sorting device signalling pre-existing ability. Signalling theory, in particular, considers education as a signal, which is

⁵ It is worthwhile mentioning that in the actual world a part of earnings variation may be ascribable to other factors, as demonstrated in chapters 5 and 6. In this section we assume that such factors are the same for all employees.

alterable and potentially subject to manipulation by the job applicants. However, under the signalling view a controversial issue arises about the relationship between education and productivity. That is, it is not very clear whether the alterability of signals such as education means that education improves the productive capacity or that it merely signals pre-existing ability. Spence's signalling theory apparently assumes that education does not improve productive capacity. (Spence, 1973: 364) However, it has recently been highlighted that signalling and screening models should be viewed as extension of the human capital model. (Weiss, 1995: 133) In Weiss' view "sorting models are mistakenly grouped with credentialism, in which wage differences are independent of productivity differences, or with models in which education has no effect on productivity. ... In addition, education surely improves productivity at certain technical managerial jobs." (*Ibid.*: 150-151)⁶

To explore this aspect of the investigation, we asked interviewees to discuss the situation of their own company about the relation between education, earnings and productivity. For that purpose, first the positive relationship between education and earnings derived from quantitative analysis was highlighted, and the interviewees were asked why they pay more to more highly educated employees. Two key points were addressed by the respondents: the sorting role and the productivity-augmenting effect of education. That is, almost all interviewees confirmed not only that educational attainment is regarded as a sorting device but also that they believe that education

⁶ A discussion concerning contrasting views of screening models is also given in Johnes (1998).

improves productivity, and therefore they expect that more highly educated candidates to be more productive.

According to the interviewees, all their companies consider educational qualification initially as a sorting device to select more productive candidates. To be recruited, as they stated, candidates should provide a copy of their educational qualifications with the application forms. After considering the application forms of candidates, companies invite the most appropriate candidates for interview. In fact, it seems that neither educational qualifications nor the information provided through the application form provides enough information to select the more appropriate and more productive candidates. For this reason, they interview a number of candidates greater than that which will be selected as prospective employees. After conducting interviews, the companies select the candidates they consider most appropriate. Those who are selected must sign a temporary employment contract, and then they can start working. During this temporary employment period (i.e. the probationary period), the performance of the employees is assessed by supervisors and managers who monitor the performance of their subordinates. If a candidate fulfils the expectations of his or her employer s/he will be recruited; otherwise his or her recruitment will be terminated at this stage.

Education is an important factor for the selection of new employees. Initially, candidates should send their educational qualifications with the application form. Based on such information, more appropriate candidates are invited for interview. The assessment of interviewers determines whether or not a candidate can be selected. After selection, a candidate should pass a six-month temporary employment period. In the case of satisfactory assessment showing that the candidate is capable and productive for such a job, he will be recruited as a permanent employee. (I-1)

Personnel are selected based on their qualifications and interview. However, for final selection they should prove their capability in practice, otherwise their employment will be terminated or they have to accept a lower (level job and) wage/salary. (I-8)

However, this does not necessarily mean that any candidate who has a degree is invited for interview. A selection from graduate applicants is made before interview, and only some people are invited for interview. Besides, employers request specific qualification for a given (especially for a high level) job:

A person may have a degree but no appropriate skills, which are important to perform a job. Such a person would face a difficult situation in practice. For example, we had a candidate with a foreign language degree. He did not have any experience and wanted to work in the export/import unit. Due to lack of skills, he was not able to request a pro forma appropriately. (I-2)

For a given job, we invite appropriate candidates who have relevant educational qualifications for interview. However, we do not invite any graduate who has a degree. ... There is the issue of managerial capability; the candidate should be able to “manage” as well. (I-9)

Therefore, the recruitment procedure indicates that education is a screening device but not a perfect one.

Besides the sorting role of education, the interviewees believe that education contributes to the improvement of the productive capacity of graduates. Education provides knowledge and skills as well as better attitudes, personality traits, etc. that make the educated more productive:

Education and higher education, especially for management, are good things that make them more productive to perform their job better and with less malfunctioning. ... More highly educated employees and managers would attempt to collaborate with other colleagues, especially with other more educated personnel, in a better way ... (I-2)

For recruitment educational qualification and experience are very important. ... There is a relation between payment and marginal product, as the theory of the firm in microeconomics predicts. Therefore, it is expected that the more educated and more experienced to be more productive, and in fact this is what we observe in practice. ... (I-5)

Especially for white-collar jobs, (educational) qualification is very important. It helps individuals to adapt and familiarise with the current situation of the firm in a shorter time. It enables people to have better collaboration with other colleagues and also better performance. (I-6)

There is also the issue of human capital density, which merits further elaboration. Generally speaking, it is believed that more highly educated people choose to work in firms and working places that already have higher human capital density.⁷ This, however, would be only one side of the coin. On the other hand, it can be argued that more highly educated employees, especially managers, could provide a better human capital density at their work place. One of the respondents highlighted the issue and stated that more qualified individuals and people with higher educational qualifications, particularly in the case of managers, would attempt to attract better and more qualified prospective colleagues. In contrast, less qualified persons would attempt to create a lower human capital density in their working place. (I-2) It is very likely that education increases productivity more in a situation of high human capital density than in a contrary situation. Therefore, all employees would benefit from such a situation. This finding is consistent with the multilevel quantitative findings, presented in chapter 6,

⁷ This issue is often referred to self-selection problem. A recent and interesting review is given in Heckman and Honore (1990).

that employees working in firms with higher average stock of human capital earn more than their counterparts working in a firm with less average stock of human capital.

There is another point that needs to be illuminated regarding the issue of the relationship between education, earnings and productivity. It has been highlighted that education signals the productive capacity of candidates. Therefore, according to this view, more educated people are more able and, in turn, more productive. According to this theoretical explanation, employers would be interested in recruiting more educated candidates regardless of the nature of the job/work. They would face a queue of candidates with a variety of educational qualifications, from primary to higher levels of education, for any given job. However, the actual situation is not so simple. That is, employers usually request a specific educational qualification for a specific job, as in the examples quoted above. For example, for a production line they may recruit individuals with a diploma degree. When recruiting a person for a managerial job, they are interested in both relevant experience and higher educational qualifications as pre-required conditions. (I-8) There would not be candidates who have not got the relevant qualifications. Thus, the employers in their selection for a particular job would face candidates with homogenous educational qualifications from whom prospective employees would be selected. At the same time they may select individuals with different educational qualifications, but for different jobs.

Although the above mentioned arguments may provide some evidence justifying the relationship between education, earnings, and productivity, it is still not clear

enough to provide evidence on the fact that education improves productive capacity of individuals. It is, however, implied that if the main function of education were to screen more able candidates, the employers should not have had any tendency to contribute, in one way or another, to the improvement of educational qualifications of their employees who have already been screened. The contribution of employers to the payment of the tuition fees of their employees could shed light on this issue and clarify the productivity-augmenting role of education. That is, it makes sense, if they believe in the productivity-augmenting role of education, that employers are also willing to contribute to the tuition fees of their employees who are part/full time students:⁸

If an employee passes the general examination to enter a university, we would help him to pay the tuition fee, etc. (I-4)

In some cases where employees succeeded in entering university we may contribute to their tuition fees. If so, they should sign a contract/agreement to work at our company after their graduation. (I-9)

In sum, the evidence presented from the respondent views shows that education is not only regarded as a screening device, even as an imperfect one, to select candidates with the capability to do a job, but is considered as an element that contributes to improving productive capacity. As demonstrated, both human capital theory and screening hypotheses imply that the more educated are paid more because they are more

⁸ Some employees may pass the general examination to enter a university. (More discussion on the education system in Iran is provided in chapter 4.) Depending on their agreement with the employers they can continue their education as a part or a full time student. In the latter case, they should terminate their work temporarily. After graduation they would come back to their previous work place.

productive.⁹ Therefore, observations on education, earnings, and productivity do not provide evidence that enables one to distinguish the human capital view from screening hypotheses. However, data from employers' views, showing that employers observe the productivity-augmenting role of education in the work place, and also data on the investment behaviour of employers when spending on the education of the employees who have already been screened, tend to support the human capital view, that education actually improves the productivity of individuals.

We also presented evidence that attaining an educational qualification does not guarantee a job. Employers would select their prospective employees for particular jobs from a number of candidates with homogenous educational qualification. Therefore, besides educational qualifications, they need to have some other selection criteria such as experience, as we elaborate in the following section.

7.5 Experience

As demonstrated in chapters 2, 5 and 6, experience is an investment that creates earnings variation among employees. In this section, we present respondents' views on why employers pay more to more experienced workers.

⁹ The same point is also stated by Mace (1987: 25) "On the one hand there is the human capital notion that more educated people earn, on average, more than the less educated people ... and that these higher earnings result from their additional education because it has raised their relative productivity. On the other hand there is the screening hypothesis which accepts the first part of the human capital proposition, that the more educated earn more, but asserts that this is because the more educated possess greater innate productive skills and this is why they are more productive and are paid more."

In the view of interviewees, experience is also an important criterion for recruitment. Employers see experience as a productive element of human capital. (e.g., I-1 and I-3) The importance of experience in improving productivity, as the respondents stated, may vary across different jobs and educational subjects and backgrounds. For example, in social sciences, where most students are not taught the very practical aspects of doing a job, relevant experience is more crucial than in engineering and medicine. Moreover, experience and education are seen as two complementary elements of productive capacity. In a respondent's words:

Academic knowledge and experience make a person more qualified to do a job. An educated person with good experience insists on a better way of doing a job, and he is more disciplined as well as more enthusiastic ... (I-2)

Nevertheless, this does not necessarily mean that the more experienced are always preferred to the less experienced. For some cases and jobs, recruiting younger employees is preferred, and for others the more experienced. One reason for the former case is the fact that employers attempt to provide a situation that enables employees to accumulate their human capital according to the situation and needs of the firm. Recouping the benefits of investment in human capital is another important factor that may encourage employers to recruit younger employees who may stay in the firm for a longer period. Whether to recruit younger employees or more experienced personnel, therefore, depends on the dominant situation:

In some cases we prefer to recruit younger workers (with less external experience). This provides opportunities for the workers to have a longer tenure in our company and better on-the-job learning and training. (I-6)

Sometimes younger workers are recruited because employers face the problem of a lack of candidates with relevant experience. The respondent (I-4) stated that “due to the fact that there is no similar producer in the region, we found it difficult to find candidates with appropriate and relevant experience.” For this reason, as well as to provide a longer career prospect for the employees, they had to recruit younger workers.

For recruitment, both education and experience are important. However, the effects of education and experience on productivity are not the same. In some jobs, education was reported as the more productive element of human capital, and in others experience:

Concerning whether education or experience is more effective to improve productivity, it depends on the job and task that the employees are doing. In lower level jobs where the task and responsibility of the employees are very specific, experience and on-the-job learning are more important. In cases where responsibilities are greater and the tasks to be done are more complicated, such as the job of technicians, supervisors, and managers, higher educational qualifications can be and are more productive. (I-6)

Human capital accumulation through experience and learning on the job is more productive since it is more close to various aspects of doing a job and a task. (I-7)

These statements about the employers' views of experience imply that employers may treat experience which is acquired inside their own company, in comparison with external experience, differently. We asked interviewees to discuss the actual situation of their own firm in that respect. As expected, the employers had different attitudes to experience acquired outside (external experience) and inside (internal experience) the firm; though both kinds of experience seem important for productivity and earnings:

... As compared with external experience (which may even be acquired in a company with a similar activity), inside or internal experience has a more significant effect on performance and productivity. Because internal experience is more relevant to the current task and is accumulated based on the structure and the situation of the current firm. It is through internal experience that workers can learn the details of doing the job. Such details are not taught in schools and universities and may not be acquirable in other firms. ... (I-8 and I-9)

These findings are consistent with our quantitative analysis presented in chapter 5. From the results of the earnings functions, in which years of experience are decomposed into internal and external experience, we found that an extra year of internal experience contributes to earnings twice as much as a year of external experience.¹⁰

The extent to which human capital can be accumulated through experience varies across different jobs:¹¹

... Learning through experience varies, depends on the nature of the jobs. Some jobs have a very limited learning opportunity. For example, a driver does not have an infinite opportunity to learn through doing. ... (I-3)

Finally, it seems that employers try to provide an appropriate learning atmosphere, so that more experienced workers can exchange their experience with the less experienced:

¹⁰ A more detailed discussion is given in chapter 5.

¹¹ In a study on skill formation systems in Japan and Southeast Asia, Koike (1990) derives the same conclusion. Through close observance and intensive interviews with veteran workers, he explores two major categories of work on the shop floor that became part of his conceptual framework: usual operations (routine, repetitive, and monotonous jobs) and unusual operations (those dealing with changes and problems occurred during repetitive and routine operations). Because of the repetitive character of usual operations, as he argues, most people are inclined to conclude that little skill is really necessary. However, the ability to deal with problems (consisting of detecting problems, diagnosing the sources of the problems, and rectifying or amending the process in order to eliminate the problems) and changes efficiently is an essential part of necessary skills and knowledge. Intellectual skills become more necessary as the technological requirements of the work become more advanced. According to his direct observation of the shop floor, on-the-job training (learning while working and following the teachers' pattern) is the principal way in which these skills are formed. (Ibid., 7-10)

To achieve a high degree of efficiency, we try to create a working environment consisting of an appropriate combination of experienced workers and more educated but less experienced ones. Such an environment would help the less experienced to learn from the more experienced. (I-9)

To sum up, in this section the significance of experience based on the respondents' views was examined. We found that experience is one of the important factors for recruitment, and human capital accumulation through experience varies across different jobs. There is a difference between the effects of internal and external experience on productivity. The same pattern is revealed when we use earnings functions in which experience is decomposed into internal and external experience. That is, the contribution of inside or internal experience to earnings is about two times greater than that of external experience, after controlling for other variables.

7.6 Training

In the previous sections, education and experience were examined from the viewpoint of employers. Training is also another key element of human capital, which is of interest. Screening hypotheses do not provide any explanation for such an investment. However, it can be argued that if education did not improve productivity, training would not make a contribution to productivity and therefore it would not be justifiable that employers spend on training programmes. In this section, first, an attempt is made to present some theoretical aspects of training from the viewpoint of employers, using Becker's training theory. Then, data on the training-investment behaviour of employers collected through interviews is presented. The findings will

help to provide evidence about the validity of human capital theory versus screening hypotheses in the actual world.

As elaborated in chapter 2, Becker in his well-known training theory introduces, what I would call, an explanation of *firm investment behaviour* in which he switches human capital theory to the matter of profit-maximising equilibrium of a firm through taking into account on-the-job training. In Becker's view, the inclusion of on-the-job training in the investment-decision process of a firm alters the conditions of the equilibrium, which depend only on the current period, and creates a connection between present and future receipts and expenditures. He then remarks:

Training might lower current receipts and raise current expenditure, yet firms could profitably provide this training if future receipts were sufficiently raised or future expenditures sufficiently lowered. Expenditures during each period need not equal wages, receipts need not equal the maximum possible marginal productivity, and expenditures and receipts during all periods would be interrelated (Becker, 1962, reprinted in: 1993: 32).

This consideration provides a base for Becker's famous distinction between *specific* and *general* training (reviewed in chapter 2). In this theoretical explanation, Becker argues that the firm will invest in human capital only if the discounted benefits accruing to the firm from the human capital investment are sufficiently large to cover the costs of the investment.

If training, for example, were given only during the initial period, expenditures during the initial period would equal wages plus the outlay on training, expenditure during other periods would equal wages alone, and receipts during all periods would equal marginal products. Equation (7.1) becomes:

$$MP_0 + \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} = W_0 + k + \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t} \quad (7.2)$$

where k measures the outlay on training. (Ibid.: 32)

In terms of empirical investigation, the key question, then, is whether the firms have had any training programme. Based on data from the interviews, almost all companies have had training programmes, and it seems that employers see training as a productive investment. Such training may be provided on the job, especially by supervisors and by more experienced workers, and/or through establishing a training course in the firm or in an educational/training institution.

To justify training programmes, interviewees stated that employees, especially newcomers, need such training to improve their capabilities. Initially, the performance of all employees is assessed by their supervisors and managers. This kind of assessment helps employers to find out whether their employees are capable of doing their jobs properly. In case of any weakness, the supervisors report the situation so that (specific) training is provided for the employees.

In a manufacturing firm like us *training* is seen as an important device/plan that enables us to be dynamic enough to compete with other rivals and to meet our targets in the market. Training for personnel may be provided as general or specific. In our company (on-the-job) training comprises both theoretical and application aspects. ... (I-1)

In cases of off-the-job training, employees would participate in the programmes and they would receive their wage and salary while attending the programmes:

When the units of our company report that some employees need special training we provide such opportunities. Training may be on-the-job or through participating in a short training course off the job. In the latter case, the employees would attend the course as well as receive their wage or salary. ... (I-4)

The findings presented above are consistent with the first part of Becker's training theory. That is, the employers view training as an investment in human capital. However, our evidence does not support the second part of the theory (i.e. the generality view of training). All training seems to be specific not in the sense of the generality of training but, as Ziderman (1978: 23) states, in the sense of the potential mobility of trainees to other firms.

Training is seen as a complement to education and experience. The main aim of such training programmes seems to be the improvement of the productive capacity of employees who are eligible to be trained. It would seem that employers, managers, and/or supervisors have a clear idea regarding the specific capability needed for doing a particular task and job. During their assessment, if they recognise that some employees need further training they will provide such opportunities for them:

To recruit a person, of course education and experience are very important. Nevertheless, candidates should be armed with specific knowledge and skills to perform their tasks properly. In case of lack of appropriate knowledge and skills, reported by the selecting committee during the recruitment procedure or by supervisors, candidates should take part in such training programmes successfully. Training programmes have various dimensions and objectives. The main purpose is to improve the productive capacity of employees. (I-5)

Some firms were able to organise more comprehensive training programmes:

We have recently established a high standard training centre. There are three full-time tutors selected from six well-qualified and trained candidates for the purpose of training other employees. It is their duty to train both new and old employees. All salesmen, for example, should attend the training course. (I-6)

Besides training personnel, one of the respondents highlighted that “it is also the tutors’ duty to assess the effects of such training on the productivity of the company, to find out whether the targets of training programmes have been achieved.”¹² (I-6)

Training programmes cover all employees, whether higher level workers or those with lower level jobs and with different educational qualifications. Nevertheless, more educated employees invest in themselves more through on-the-job training in comparison with less educated workers.¹³ In a respondent’s words:

There are also (on-the-job) training opportunities for lower level workers. However, it is the more skilled and more highly educated employees who mostly need to attend training courses, and they do so. (I-6)

It is worth noting that quantitative data also supports the above-mentioned point. Using data from a large company that provided all the requested data for the purpose of our quantitative analyses, we estimated by applying a logistic method the effect of education and experience on the probability of receiving training. It was found that both education and experience have a positive effect on the probability of being trained. As

¹² Attempts were made to interview the head of the training centre regarding how they assess the effects of training programmes on productivity and performance of the trainees. But we could not succeed in conducting such an interview.

¹³ Mincer (1974: 131), for example, points out that in dollar volumes the relation between schooling and post-school investments is found to be positive. This finding is consistent with a notion of complementarity between the two investment forms.

Table 7.2 shows, the probability of being trained increases with years of schooling, holding years of experience constant. For example, the probability that an employee with 5 years of schooling receives a training course is less than one percent, while the equivalent figure for a person with 16 years of schooling is 44.3 percent, holding years of experience constant at 10. The same pattern appears for experience. That is, when years of experience increase from 10 to 20, the chance of being trained increases from 44.3 to 70.5 percent, with the same years of schooling (i.e., 16).

Table 7.2: The effects of education and experience on the probability of being trained using Logistic Method

Years of Experience		Years of schooling		
		5	12	16
10	Prob.*	.0053	.1143	.4432
	Z**	-5.233	-2.48	-.228
20	Prob.	.016	.279	.705
	Z	-4.133	-.948	.871

Notes: * Prob. stands for the probability of being trained and is calculated based on $\{1/(1+e^{-z})\}$.

** Z is the estimated function.

Data from questionnaires for the purpose of quantitative analysis also help us to elaborate these firms' training programmes in more detail. In the above mentioned company about 5 percent of employees received training, during the year March 1995-March 1996. All participants were permanent employees who had a secure job in the company. This in fact supports the view that there is low potential mobility of such employees, and therefore the employer would be sure that the investment would not be lost through quitting. Almost all courses were relevant to the current jobs of the

participants. This confirms the issue of the relevancy of (on/off-the-job) training to perform a job, in comparison with formal education. As discussed in chapter 5, these findings support the view that management is an element of human capital, because to be a manager one may need to receive a specific training course. It was also stated that managerial jobs might provide a better opportunity to accumulate human capital. Data on employees who received training show that about 57 percent of participants were managers or applying for a managerial job when they attended such programmes. In terms of subject, the courses covered a variety of subjects, and management and computer or computing courses were among the most frequent.

It might be argued that training is provided just for the sake of promotion. Data collected through interviews such as that which is quoted below reveal that training programmes, like education, make employees more productive and more capable of doing higher level jobs:

There is on-the-job training for newcomers provided by experienced workers and specific training courses for others. For example, we selected some workers from the local employees to be trained in special training courses for higher level jobs. After training they could demonstrate that they are more capable of the higher level jobs in comparison with their counterparts who are non-local employees. Their success is due to the training programmes and the fact that they have a similar social and cultural background to their subordinates who are mainly local employees. ... (I-7)

Both specific and general training is provided, and that such training may be supplied in the firm or in another place or an educational/training centre. In any case, the employers expect training to improve productivity:

In our training centre, we provide general training such as English language courses, computer courses, etc. mainly for new employees. Specific training is mainly supplied for employees who are selected by supervisors and managers as eligible workers to be trained. If the centre cannot supply the training courses which are needed, employees are introduced to some other educational and training institutions to attend such special programmes as full time trainees. ... Training and especially specific training programmes affect the productivity of employees. (I-9)

Becker's training theory predicts that the cost of general training should be paid by employees who recoup the benefits of training. On other hand, the cost of specific training is paid by employers, since specific training improves the productivity of employees only at the firm that provides such training. Therefore, the firm can recoup the benefits of specific training. Our empirical data, however, reveals that the costs of both general and specific training are paid by employers. (e.g. I-9) As mentioned earlier, through establishing special mechanisms such as an internal labour market and contracts, employers reduce the chance that an employee in whom investment has been made may quit the firm. This weakens the relevancy of the classification of training by Becker. Both employees and the employers are able recoup the benefits of training in the time that training is provided as well as in future:

Costs of training are paid by the company. Of course, we expect to recoup the whole benefits of training programmes in the future. ... To provide better incentives for the trained workers we share the benefits of training with them through their promotion and increasing their earnings. (I-9)

In some cases it was stated that when participants in training programmes could obtain a good score (i.e. score between 17 and 20 out of 20) they would be rewarded with up to 5 percent of their wage/salary. (I-1) In the respondent's view such

opportunities of promotion and signals would encourage trainees to participate in the programmes.¹⁴

It might be plausible to assume that, to some extent, education and training are substitutes for each other. However, in practice they are complementary. “Education and on-the-job training are complementary investments.” (I-4)

Finally, although employers view training as a productive investment, the extent to which such an investment may increase productivity varies with the kinds of training in terms of their relevancy to performing a job. “Training, especially specific training, is more useful to improve productivity because it can meet better the company’s needs.” (I-4)

In this section, the investment behaviour of employers about training was presented, using data derived from interviews. It was found that the employers do invest in human capital through training to improve the productive capacity of their employees. Although such investment (training) may be specific or general, in Becker’s terminology, it is the employers who pay for the costs of training. Both employers and employees recoup the benefits of training. The respondents stated that more educated workers tend to invest more through (on-the-job) training. The results of a logistic model using data from quantitative questionnaires support such an argument. It seems that training is seen as a complement to other kinds of investment in human capital

¹⁴ The estimated earnings functions for a large firm (employing 2200 workers) show that receiving training increases hourly earnings by 3.5 percent, after controlling for other factors (i.e. S, S², X, X², SX, and M) affecting earnings. This finding indicates that training is a good investment for employees as well.

(education and experience) in the sense that it provides the trainees with appropriate skills, which enable them to perform a specific job more efficiently.

7.7 Extreme Values and Outliers

In chapters 5 and 6 we studied earnings variation among employees in the context of human capital theory. Our data collected through questionnaires enabled us to evaluate the effects of the main human capital variables and some firm characteristics on earnings. Although including such variables enabled us to explain a large part of earnings differentials, there is still a part of earnings variation that remains unexplained. Of course, one explanation for such an unexplained part would be ascribable to randomness and chance. However, randomness or chance is not the whole answer. There might be some other factors that cause the variation but were not included in the analyses. The omission of such factors from an analysis may also lead to a situation where an observation(s) is far removed from the rest of the observations. Such an observation is called an *outlier* or *extreme value*. (Maddala, 1992: 89) In this section, an attempt is made to explain such possible factors causing earnings variation, which were not included in the earnings functions. For that purpose, the omitted factors are divided into two parts; the first relates to firm level variables, and the second to employees'. Another classification can be made for the variables of each level of analysis; that is, the variables that were included in the questionnaires (but not in the analyses) and the variables that were not.

For both levels of analysis, the variables included in the questionnaires are training, shift work, night work, difficulty of task, job (heterogeneity), and subject of study at employee level, and accommodation benefits and working in a difficult atmosphere at firm level.¹⁵ Data on these variables were not provided by all firms, so that we could not incorporate the variables in the earnings functions, to account for earnings variation due to such factors. However, running a separate earnings function for a firm providing such data shows that these variables are important earnings determinants.¹⁶ In some cases data were given, but the extent of variation and diversity of variables especially among units of level 2 (firms), are so complicated and wide that the application of the simple dummy variable technique, which was considered to deal with such factors, was not adequate.

During interviews, we asked the respondents to give an explanation for the unexplained part and the outliers. Almost all interviewees highlighted the importance of human capital variables and the above mentioned factors. They also stated that there are some other elements, such as accommodation loans, occasional rewards, non-pecuniary benefits, pay for performance, kind of jobs, and payment in kind that may account for outliers or the unexplained part. That is, some but not all firms provide accommodation loans or cheap accommodation for some employees. Some firms give their employees

¹⁵ More discussion is given in chapter 3.

¹⁶ For instance, using an Mincerian earnings function, it was found that (i) a shift worker earned 6.1 percent more than a non-shift worker, (ii) a night-work employee was paid 4 percent more than a day-work employee, and (iii) an employee who received training during 1995 earned 4 percent more than his counterpart not receiving training. It is worth noting that the inclusion of such factors does not weaken the estimated effects of schooling and experience on earnings. We shall discuss this in further detail later on.

the products of their own company free or at a discounted price. To create an atmosphere encouraging hard work, employers offer special rewards to some enthusiastic workers. Such rewards may be pecuniary or non-pecuniary, such as an announcement in a newspaper and/or a letter of commendation. Specific workers, such as security officers, have to stay for longer hours at work. This leads to decreasing their hourly earnings, which were calculated by “annual earnings divided by annual hours worked”. Some personnel, especially those working at the top management level, have to stay longer than the usual hours of work but their actual hours of work may be more than their recorded hours of work. This in turn leads to overstating the hourly earnings for such employees. It is reported that the wages/salaries of some employees directly relate to their performance, especially in the case of salesmen. Sometimes the efforts of such employees, or some external factors, may create extra-ordinary payment variations.

All such factors inevitably contribute to earnings variation, and their omission from an earnings function may lead to making outliers, mainly at the employee level, and their effects are left to the error term.¹⁷ However, it should be acknowledged that measuring some of the factors is difficult, and incorporating all quantifiable variables for a large number of firms and employees is indeed a difficult and almost an impossible task. The omission of such factors may affect the estimates of human capital variables. In other words, the estimated earnings functions would face the problem of

¹⁷ As Maddala (1992: 64) points out, the error term is a *catchall* for the effects of all omitted variables, some of which may not even be quantifiable, and some of which may not even be identifiable.

misspecification, which in turn may lead to bias in the estimates. The extent of bias depends on the correlation between the human capital variables, which are included, and the omitted ones.

We can classify the omitted variables into two groups. One may be attributed to the employee level, such as occasional rewards, shift work, night work, etc. and the other to the firm level, such as cheap or loan accommodation, location of firm in a difficult atmosphere, and/or payment in kind. This latter group, in fact, creates cluster effects; for example, employees may accept a lower wage/salary if they receive cheap accommodation or payment in kind, and vice versa. In other words, an employee may receive lower wage/salary in a firm where free or cheap accommodation is provided for the employees. The multilevel technique, however, deals with such cluster effects.

The situation of the first group of variables is slightly different. That is, some variables are positively correlated with human capital variables and others negatively. The evaluation of the sum of bias due to omitted variables needs to be investigated empirically. However, it seems that most of the variables are negatively correlated with human capital variables. For example, using a sub-sample of observations, we found that employees who were shift workers or chose to work at night were less educated and experienced employees. In other words, the probability of being a shift worker decreases with higher levels of education and more experience. Therefore, it is likely

that the omission of such variables understates the effects of human capital variables on earnings.¹⁸

7.8 Summary and Conclusion

In sum, we have presented information and evidence derived from interviews, reflecting the viewpoint of the representatives of employers, that education is initially regarded as a sorting device. Employees are paid more because, as the respondents stated, they are more productive. However, this does not provide evidence for the notion that education improves productivity, since both human capital theory and screening hypotheses predict that the more educated are more productive than the less educated. Therefore, the next question that was addressed in interviews is whether education improves productivity. Such a question would provide direct evaluation by employers about the productivity-augmenting role of education. In that respect, employers, drawing from their observations and experience in the work place, acknowledged that education improves the productive capacity of employees. The contribution of employers to paying their employees' tuition fees studying at higher educational institutions could also be regarded as evidence that supports the argument.

¹⁸ As mentioned earlier, footnote 16, using a sub-sample of observations, we estimated the effects of training, shift work, and night work on earnings and found that the variables affect earnings positively. After including the variables in an earnings function, the estimated effects of education and experience increase slightly.

For different jobs employers demand different educational qualifications, and it is not the case that more education is always preferred, as implied by screening hypotheses. On the contrary, attaining a degree does not guarantee a job. For a specific job, employers usually select their prospective employees from a group of candidates with the same educational qualifications. Besides, education is not the only means of investment in human capital. Learning through experience and training on or off the job are also other methods of investment, and these methods are regarded as complements to education and as productive factors.

In the case of experience, two kinds of experience, internal and external, were recognised. Although both kinds of experience are viewed as productivity-enhancing factors, internal experience was reported as more relevant to current jobs and more productive. As the earnings function analyses showed, internal experience is, therefore, rewarded more than external experience.

Data presented in this chapter suggest that employers have a strong view on the importance and usefulness of training for productivity, which is consistent with Becker's training theory. However, screening hypotheses fail to provide an explanation for such an investment in human capital.

Employers provide training and pay for such investments, for both general and specific training. This empirical evidence may apparently contradict the second part of Becker's theory of training, which predicts that trainees should pay the cost of general training. In fact, it is the employer who recoups the benefits of training and other kinds of investment in human capital through establishing an internal labour market and

contracts that prevent employees from quitting their current firm. This suggests that the issue of potential mobility rather than the generality of training is the main concern of employers when they finance and provide training. However, almost all respondents highlighted the point that to motivate employees and to benefit from the effects of training on productivity they do share the benefits of training with the employees who received training. The results of an earnings function using a sub-sample of employees also support such an argument.

As the respondents stated, the employers expect to recoup the benefits of training in the current period as well as in the future. This empirical evidence, which is consistent with the theoretical explanation by Becker, has an empirical implication in the sense that to evaluate the benefits of training one has to incorporate the effects of training during all periods, otherwise the benefits of training would be understated.

Overall, although this qualitative analysis cannot be regarded as a thorough test of human capital theory versus screening hypotheses about the productivity-augmenting role of investment in human capital, in general, and in education, in particular, the results tend to support the human capital view. It may not be possible to generalise this key point to the whole labour market; however, it can be held for the case of profit-maximising firms, specifically in the manufacturing sector, which select their employees from a large number of candidates.

Moreover, it seems that employers expect that investments in human capital contribute, at least, to the cognitive knowledge, (psychomotor) skills and effective behavioural traits of an individual, such a classification of educational objectives was

provided by Bloom in 1956. (Cited in Blaug, 1990:12-13) The extent to which education, experience, or training affects such characteristics are different, and education seems to affect mainly cognitive knowledge and effective behavioural traits, while experience and training mainly affect skills. Perhaps, due to such specifications, employers regard education, experience, and training as complementary. Little attention, however, has been paid to such a consideration about the elements of human capital. Our methods in this chapter can also provide a conceptual framework for further in-depth and qualitative investigations.

Some possible explanations were presented in the last section of this chapter in connection with the unexplained part of earnings variation and with extreme values. It was demonstrated that there are still other factors that affect earnings. As discussed, some of the variables may create a cluster effect. Others may be correlated with human capital variables, either negatively or positively. Measuring and incorporating all of these factors in an analysis is an almost impossible task. This implies that the estimates of human capital variables derived from an earnings function would face the problem of misspecification and potential bias. The precise and final bias due to omitted variables needs to be investigated empirically. However, it seems that most of the variables are negatively correlated with human capital variables. Therefore, it is likely that the omission of such variables understates the effects of human capital variables on earnings, as demonstrated for the cases of training, shift work, and night work. Moreover, the multilevel technique can help a researcher to deal with such complexity, in particular in connection with the variables that affect the cluster effect. However

collecting data that enables a researcher to conduct, for example, a five level method of analysis remains the main issue.

Chapter 8 Summary and Conclusions

Economists have long been interested in the questions *why do individuals invest in themselves?* and *Do investments in human capital explain earnings variation among individuals?* We adopted the human capital hypothesis, arguing that an individual undergoes and pays for educational activities for the sake of future economic benefits, particularly earnings. One of the aims of this study, therefore, is to investigate the extent to which investments in human capital contribute to increasing earnings in the manufacturing sector in Iran. For that purpose, both the OLS and multilevel techniques were employed. In particular, it was of interest to examine the advantages of the new technique of multilevel modelling for the human capital analysis of earnings differentials. Attempts were also made to examine the question *why* investments in human capital increase earnings.

This chapter presents the main findings and conclusions of the thesis. The first two sections evaluate the findings in relation to the aims of the thesis and to economic

theory. The third section considers the policy implications derived from the empirical findings. And in the final section areas for further research are identified.

8.1 Human Capital and Earnings

8.1.1 Summary of Remarks

As the literature reviewed in chapter 2 showed, the notion of human capital stems from the ideas of Adam Smith, who identified the improvement of workers' skills (e.g., through education) as a source of personal incomes which partly explains earnings differentials. However, in the 1930s empirical investigations were conducted in this area. For example, the work of Walsh (1935) investigated whether expenditures incurred by persons for professional careers were a capital investment made in a profit-seeking and an equalising market, and in response to the same motives that lead to investments in conventional capital. In the early 1960s this notion entered the mainstream of economic literature, when Schultz (1961) in his inaugural lecture to the American Economic Association analysed educational expenditure as a form of investment, and by Becker's book with the title of *Human Capital* (1964). In this Becker developed a theory of human capital formation and analysed returns to investments in human capital.

The basic idea of the human capital approach is that variations in the earnings of employees are due, in part, to differences in employee quality in terms of the amount of human capital acquired through education, on-the-job learning, and training.

Since that time very many attempts have been devoted to test the key notions of human capital theory. In particular, using earnings functions, efforts have been made to establish a relationship between *education*, *training* and *earnings* and, in turn, to evaluate the returns to education and training.¹ Generally speaking, the results of all studies support the existence of an association between more education and higher earnings. Such finding has been regarded as evidence indicating that education and (on-the-job) training are good investments, which are rewarded by pecuniary benefits in the labour market.

However, in the manufacturing sector of Iran no study has been conducted that investigates earnings differentials in the context of human capital theory. Therefore, the first research question which this thesis investigates is “*whether and to what extent education and training contribute to increasing earnings in the specific case of manufacturing sector in Iran*”.

As presented in chapter 2, the conventional evaluation of returns to education and the contribution of education and training (experience) to increasing earnings, derived from the Mincerian earnings function, has been questioned because it ignores, among

¹ Some of the most well known are the studies by Mincer (1958, 1974), Psacharopoulos (1973, 1981, 1985), Psacharopoulos and Williams (1973), Psacharopoulos and Layard (1979), Becker (1962, 1993), Schultz (1961, 1962), Carnoy (1995), Griffin et al. (1996), Kingdon (1997) and Cooper and Cohn (1997).

other factors, the quality of education (Griliches, 1977; Betts, 1995), ability (Griliches, 1977; Fagerlind, 1987), employer size (Siebert and Addison, 1991, cited in Polachek and Siebert, 1993; Idson, 1995; Velenchik, 1997), team work (Idson, 1995), and geographical aggregation (Bisdsall and Behrman, 1984; Griffin and Edwards, 1993; and Velenchik, 1997). It has been argued that ignoring these factors leads to bias in estimating the returns to education and training. In this study, an attempt was also made to examine whether such criticisms held for the case of the manufacturing sector in Iran.

Moreover, reviewing the literature, we found that little attention has been devoted to assessing the efficiency of the conventional OLS estimates that rely on data dominated by a hierarchical structure. This is in fact the main concern of the new technique of multilevel analysis, whose supporters argue that in a hierarchical structure the OLS estimators are not efficient (Goldstein, 1995). As argued in chapter 3, data collected to investigate earnings differentials in the context of human capital theory are dominated by a hierarchical or clustered structure in the sense that the units grouped at different levels, and the relationship between dependent and independent variables varies from one group to another. In relation to such issues, the literature reviewed in chapter 2 showed that the effect of human capital variables on earnings is different across different geographical areas (e.g., Chiswick, 1974; Velenchik, 1997), economic sectors (e.g., Mincer and Higuchi, 1988; and Velenchik, 1997), etc. Dummy variable technique has been used to deal with such differences and variations. No systematic analysis, however, has been conducted through applying varying coefficient models to investigate such a varying structure. Little effort, if any, has been made to examine whether the variation of the coefficients of the human capital variable is explainable, for

example, by the characteristics of firms. These aspects of the evaluation of human capital variables on earnings led us to address the second main research question: *“whether a multilevel statistical analysis is a more appropriate approach than the conventional OLS one for evaluating the effects of education and training (experience) on earnings”*.

We attempted, as elaborated in chapter 3, to incorporate such heterogeneities across the groups/clusters (i.e., firms) into the empirical analyses of earnings through employing the multilevel technique. In particular, we chose employees as the basic units of analysis, which are clustered in firms. In this consideration, it was assumed that employees influence and are influenced by firms. This enabled us to categorise the determinants of earnings into two groups: the characteristics of employees and those of firms. Education, experience, and management were included in earnings functions as the characteristics of employees, and size of firm, geographical location, industry as those of firms. This latter group of variables was described as the conventional firm variables. The cluster analysis also allowed us to include contextual variables such as the average stock of human capital and average hours worked in each firm. In particular, the average stock of human capital enabled us partly to deal with the issue of the monetary externality of human capital density, which has long been of interest to economists. So far little empirical evidence, if any, has been provided about such monetary externalities. (Blaug, 1990; Schultz, 1993; and McMahon, 1997)

The contribution of years of schooling to earnings across different levels of education is conventionally assumed to be constant (Mincer, 1974: 11). However, it is

more plausible to assume that the coefficient of schooling depends on levels of education in the sense that one extra year of schooling at different levels of education improves the earnings capacity of an individual differently, from the viewpoint of the supply side. From the demand side, the extent to which technological developments may affect the demand for educational qualifications is not necessarily constant across time. Besides, in a cross-section method of analysis the units of analysis (i.e., employees) are not necessarily homogenous (apart from the conventional human capital variables). For example, employees may have had different opportunities (i.e., heterogeneity in innate ability, finance and social background) to invest in themselves. They may also have experienced different *qualities* of education during their schooling as well as post-schooling investment. All these heterogeneities affect human capital accumulation and in turn earnings capacity, which are hardly captured by the conventional years of schooling variable.

Finally, it is well established that more educated workers tend to invest more through training and experience, in comparison with the less educated. In that respect empirical studies show a lot of controversy. Moreover, most of the empirical studies have used the estimated instead of actual years of experience to account for earnings differentials attributable to on-the-job training. Little work has been done to evaluate the relevancy of such a measurement in the context of a country like Iran.

Data on the characteristics of 15755 employees clustered in 35 firms from the manufacturing sector in Iran was collected, and both the single-level technique and the multilevel methodology were employed to examine the research questions and the

issues of interest. The main findings and implications are presented in the following section.

8.1.2 Empirical Findings and Implications

With regard to the first research question, it was found that the amount of education and experience is significantly and systematically associated with earnings of the employees. That is, more educated (experienced) employees receive more earnings than less educated (experienced) ones. The association between higher education and experience and higher earnings (i) provides evidence that individuals have rational and optimising, rather than random, behaviour in investing in themselves, as economic theory predicts, and (ii) tends to corroborate the notion that human capital acquired through education and experience improving the earnings capacity of individuals is subject to economic benefits. These benefits and in turn the profitability of education would justify borrowing money for investment in human capital.

Using a single-level method of analysis (OLS), we demonstrated that both human capital and firm variables contribute significantly to increasing earnings. The findings of human capital variables indicate that human capital theory is an important tool for studying earnings differentials in the manufacturing sector, and are consistent with other empirical analyses of earnings in the context of human capital theory. It can be concluded, therefore, that the manufacturing labour market in Iran functions much like labour markets elsewhere. To the extent that the Iranian manufacturing labour market differs from others, it is a difference in degree, not a difference in kind.

The findings of firm variables support the criticisms of the basic Mincerian earnings function, which argue that the function ignores the firm variables and other earnings determinants and, therefore, provides biased estimates of education and experience on earnings.

The multilevel approach, besides evaluating the contributions of schooling and experience to earnings, enabled us (i) to test if data used are dominated by a hierarchical structure, (ii) to decompose and to evaluate earnings variation attributable to individual and firm levels, and (iii) to provide evidence for the pecuniary externality effect of human capital on earnings.

Based on the multilevel estimates, about 47% of earnings variation is attributed to the firm level, and the employee level accounts for 53% of the variation. This finding highlights the issue of the hierarchical structure of data used, and the point that firm characteristics are also important determinants of earnings. The firm variables echo the importance of the demand for (the services of) human capital, which influences the earnings.

Besides the existence of a high intra-unit correlation, as presented in chapter 6, the results of multilevel analysis confirm that the effects of education and experience on earnings vary across the selected companies. All this empirical evidence indicates that data used are dominated by a hierarchical structure. Therefore, the OLS estimates are not efficient and employing an earnings function for overall observations under an OLS methodology misleads us in the testing of hypotheses. In Table 6.3, Model 1 (chapter 6) it was shown that when we employ an OLS methodology most coefficients for firm

variables employed in this study (i.e., size of firm, geographical location, and economic sector variables) and interaction between these variables and years of schooling and years of experience significantly affect the earnings of employees. Conventionally, one may interpret the results to conclude that employees whose firm, for example, is located in large cities like Tehran earn 17.4% more than their counterparts working in firms located in small cities. However, once the coefficients for years of schooling and years of experience are considered as random coefficients varying across firms, as in Model 3, all the variables, except the interaction between years of schooling and size, geographical location and economic sector, change to become insignificant. That is, under Model 3 employing the multilevel methodology, neither size of firm, geographical location, and economic sector nor their interactions with years of experience can significantly explain earnings differentials across the firms. Therefore, OLS estimates not only failed to evaluate earnings differentials attributed to the firm's characteristics and in turn to explore the real explanatory variables at firm level, but also misled us in the testing of hypotheses.

A positive and non-linear relationship is found between years of schooling and earnings. That is, the contribution of years of schooling to earnings varies with the levels of education. For example, an extra year of schooling at tertiary level contributes more to earnings than an extra year at secondary level (5.5% in comparison with 4.7%, derived from Model 4, Table 6.6). The same results have recently been reported by Dougherty and Jimenez (1991), Kingdon (1997), Arias and McMahon (1997) and Light (1998). These findings provide evidence that:

1. Higher levels of education are more vocationalised than lower levels, in the sense that students are taught the subjects which are relatively more relevant to performing a job. (Machlup, 1984, and Williams, 1985, make the same point.)
2. A student studying at a higher level of education can invest more in him/herself compared to a student studying at secondary or primary level. It is expected that this extra capability of accumulation of human capital, in turn, improves earnings capacity.²
3. There is also a demand-side implication in the sense that demand for human capital has probably been growing more, relative to the supply of more educated workers. This would lead to increasing earnings in the labour market in favour of more highly educated employees.

Our findings regarding the effect of years of experience on earnings confirm previous empirical work. That is, the earnings function is concave in experience, as is suggested by human capital theory. According to this theory, as Mincer (1979: 5) states, the life-cycle growth of earnings reflects the rate of accumulation of personal investments, indicating that much investment in the individual is concentrated at younger ages. The investments may increase initially, but continue at a diminishing rate through the rest of the working life. This behaviour is due to the fact that (i) the cost of investment, especially earnings forgone, increases through the life cycle, and (ii) young

² This point was initially addressed by Bowman (1961) and so far, to my knowledge, little attention, if any, has been paid to such an important issue in empirical (human capital) analysis of earnings.

people have greater opportunity to collect the return to their investment over more years.

The well-known Mincerian earnings function and most other empirical studies employing the earnings function assume that individuals start their working lives immediately after graduation. Our data about actual years of experience enabled us to evaluate the validity of such an assumption. We found that individuals with different educational levels experienced different (un)employment patterns; the more educated experienced a shorter unemployment period after graduation than the less educated. Such a pattern seems to be plausible for all countries experiencing a high rate of unemployment, especially for developing countries.³ As a consequence, including the estimated, instead of actual, years of experience in an earnings function would overstate the effect of experience on earnings, as demonstrated in chapter 6.

A positive relation is also found between the effects of years of schooling and years of experience on earnings. The contribution of an extra year of schooling for an employee with a higher education degree (i.e. $S=16$) and 10 years of experience is 4.8 percent. The equivalent figure for a person with the same level of education and 30 years of experience is 6.3 percent. Likewise, the marginal effect of experience on earnings increases with years of schooling; an extra year of experience for an employee with 8 years of schooling and 10 years of experience increases earnings by 2.5 percent.

³ In the case of Egypt Arabsheibani (1996) notes the same point.

The equivalent figure for the person with 16 years of schooling is 3.3 percent.⁴ These findings provide evidence concerning the point that more educated workers may accept relatively lower levels of wage/salary at the beginning of their working life in return for better learning prospects, and that the more educated invest more in themselves through experience and on-the-job training. Employing a logistic model using data from a sub-sample, we also found that the more educated employees were more likely to invest in training than the less educated. The findings also highlight the fact that education, training and experience are complementary rather than substitutable. Our qualitative analysis also supports the point.

As mentioned earlier, due to the heterogeneity of human capital among the employees, holding years of schooling, years of experience, and management constant, there are still some earnings variation attributable to partly un-observable elements of human capital such as the quality of schooling and experience. It should be acknowledged that collecting data about the quality of education and experience is a difficult task and we could not collect data for such elements of human capital in order to evaluate their effect on earnings; however, the multilevel technique helped us to evaluate the overall effect of such unobservable variables on earnings differentials. For that purpose, we considered the coefficients for years of schooling and years of experience as random coefficients varying among the employees. Our statistical tests support such assumptions. This finding provides two implications for econometric and

⁴ The findings presented here are average contribution of schooling and experience to earnings. The effects vary across the firms that will be discussed later.

economic theory. One is, it indicates that the earnings functions employed face the problems of heteroscedasticity⁵ and misspecification partly due to omission of the unobservable variables, which are associated with years of schooling and years of experience.

The other is the fact that unobservable elements of human capital have a significant effect on earnings and productivity, which is of interest to employers too. In other words, it indicates that employers choose their prospective employees from a homogenous group of candidates (in terms of educational level) but in their selection they focus on the specific elements of human capital, such as the quality of education and experience.

As mentioned earlier, the multilevel analysis of earnings showed that the relationship between earnings and human capital variables varies across the firms. The implications of the varying effects of education and experience on earnings can be illuminated in two dimensions; the first is to conclude that education and experience are more productive in some firms than in others. This variation in productivity may be due to chance/randomness and/or the fact that there are some factors (i.e., firm level variables), which are significantly associated with productivity. We have attempted to incorporate the firm level variables in an earnings function to find out whether these variables account for such higher productivity. Among the firm variables, as classified into the conventional and contextual variables in chapter 6, only the contextual

⁵ The same findings reported by Dougherty and Jimenez (1993) and Akbari and Ogwang (1996).

variables, that is average stock of human capital and average hours of work in each firm, could significantly explain, in part, the varying structure of earnings across the selected companies.⁶ The findings of the multilevel analysis, therefore, highlight the importance of human capital variables and weaken the role of non-human capital variables in the determination of earnings. This supports the view that human capital theory is a powerful tool in explaining earnings differentials.

As mentioned above, the contextual variables, in particular the average stock of human capital in a firm, explain in part the variation of earnings across the firms. For example, we found that an employee working in a firm with an extra unit of average stock of human capital earns some 2% more than his counterpart in a firm with a lower average human capital. This interesting finding sheds light on the issue of the monetary externality effect of investments in human capital. It can be inferred that more highly educated and experienced workers would be attracted to firms with a higher average stock of human capital, and not necessarily to larger firms, because they would also benefit from the externality of human capital density of their working place. Regarding the other dimension, it can be inferred that in a situation where investments in human capital are more productive an individual would have a stronger motivation to invest in himself, especially through experience and on/off-the-job training.

⁶ It is worthwhile noting that increasing the number of observations at level 2 (i.e., firms) would provide a better base to evaluate the extent to which the conventional firm variables would explain earnings variation attributed to the firm level.

Overall, our findings, derived from the quantitative analysis, confirm the existence of a hierarchical organisation in data derived from the case study which investigated a relatively homogenous set of firms. As a result, the OLS estimates were found unreliable for the hypothesis testing. Thus, in a case where firms are selected from a relatively heterogeneous set of firms clustered within different economic sectors, the matter of hierarchical structure may be more apparent. (Due to resource limitations we were not able to collect such a data set.) Indeed, when one includes other dimensions such as the variations of return to education across different time spans and different jobs, the hierarchical effects would be more important to consider in an analysis for the purpose of policy implications.

As discussed in chapter 7, some other earnings determinants, which we thought of as important in the analysis of earnings in the manufacturing sector, were included in the questionnaires; but only some firms provided data on these factors. As a result, we were not able to include all of the important variables influencing earnings for all observations. However, running earnings functions using a sub-sample of data showed that they significantly affect earnings and correlate with other human capital variables. The omission of such variables may lead to bias in the estimates of education and experience variables. For example, the omission of some of the variables, such as training, may overstate the coefficients of education and experience variables and the omission of others, such as shift work and night work, may understate the coefficients. The sum of positive and negative effects of the omitted variables on the coefficients needs to be investigated empirically. Where appropriate data is not available, it is difficult to make an assumption about the downward or upward effect of the omitted

variables on the coefficients of human capital variables included in the analysis. Practically it may be impossible to include all of the important variables in an earnings function; however we should be cautious about the precision of the estimates.

8.2 Human Capital Theory and Screening Hypotheses

Regardless of the fact that there exists a strong association between higher education and higher earnings from an individual standpoint, the reason why (higher) education leads to higher earnings has long been debated between human capital theorists and the supporters of the screening hypothesis. The human capital view holds that education provides the cognitive, behavioural and manual capacities that increase productivity on the job and therefore earnings. In contrast, in the screening and signalling theories of Arrow (1973), Spence (1974), and Stiglitz (1975) education is an indicator of pre-existing ability. That is, more able individuals invest in education to signal their higher abilities, and employers, therefore, use educational qualifications to select more able individuals in the absence of any better information, but education itself does not contribute to productivity. Several attempts have been made to study empirically the claims of human capital theory and its rival hypotheses through employing various research methods such as investigating the relation between education and productivity in agriculture (e.g., Welch, 1970; Lockheed, 1987) and industry (e.g., Fuller, 1970; Min, 1987 cited in Carnoy, 1994); comparing earnings of the self-employed as non-screened group with those of the employed as screened group (e.g., Wolpin, 1977; Riley, 1979; Katz and Ziderman, 1980; Grubb, 1993; Arabsheibani

and Rees, 1998); and examining supervisors' ratings of their subordinates as a productivity criterion (Medoff and Abraham, 1981).

As argued in chapter 2 and 7, these studies at best provided evidence that the more educated are paid more because they are more productive. They do not, however, address whether this higher productivity is because of the higher ability of the more educated, as screening hypotheses predict, or the productivity-augmenting role of education. As discussed in chapter 7, little attention has been devoted to the core of the debate, that is *why employers are willing to pay more to more highly educated workers and whether they actually observe and, therefore, consider education as a productivity-enhancing element*. In our qualitative analysis, we extended the debate from the specific case of education to the case of “education, experience, and training”.

In that connection we interviewed the representatives of ten firms who have been involved in making and implementing wage and employment policies in their own companies. Data derived from these interviews were used to shed light on the third research question: *whether the contribution of education and training is due to the productivity-augmenting role of education or education serves only as a filter to identify abler workers*.

In chapter 7 we presented information and evidence derived from the views of interviewees. Overall, we found that education is initially regarded as a sorting device, even though an imperfect one. That is, for a particular job, employers would request certain educational qualifications, given that other factors are the same. However, the responses of employers showed that the real situation is not a simple case that for a

particular job, employers face a queue of candidates with different educational qualifications. In fact, as interviewees pointed out, a certain educational qualification is necessary to perform a particular job. The educational qualifications of the candidates for such jobs are relatively homogenous and, therefore, the results cast doubt on the claim of the screening hypothesis that education merely serves as a screening device. Moreover, if the role of education were only sorting and screening, employers would always prefer to invite the more educated for any job. In reality, however, they request different educational qualifications for different jobs. It is also implied that there would not be any other selection device such as an interview or the temporary employment (i.e., probationary) period in which employers assess the performance of employees for final selection.

More importantly, in the view of employers education improves the productive capacity of employees. The contribution of employers to paying the tuition fees of their employees studying at higher educational institutions could be regarded as evidence to support the argument. That is, if education did not contribute to improve productive capacity, employers would not be willing to contribute to the payment of the tuition fees of their employees who have already passed the selection process.

Although the key point of the productivity-augmenting effect of education may not be generalisable to the whole labour market and the small number of interviewees may make us cautious about the generalisability of the results, it may be held for the case of profit-maximising firms, specifically in the manufacturing sector, that the employers select their employees from a large number of candidates. However, this

does not mean that attaining a degree guarantees a job. For a specific job, employers usually select their prospective employees from a group of candidates with the same educational qualification. Besides, education is not the only means of investment in human capital. Learning through experience and training are also other sources of investments, which are mainly regarded as complements to education.

Experience is also a productivity-enhancing element, in the view of employers. The effect of experience on productivity is different across different places of work and different jobs. Human capital acquired through internal experience is reported to be more effective than external experience in increasing productivity. We have also found that the accumulation of human capital through learning and training on the job varies across jobs. Moreover, learning opportunities in any particular job seem to be limited. Therefore, it is inferred that the internal labour market is an important process for improving the accumulation of human capital through on-the-job learning and training and, in turn, productivity. From the viewpoint of an employee, it is expected that this variation contributes to earnings differentials, as human capital predicts. To take into account such variations and to evaluate the economic benefits of these investments, years of experience, conventionally used in empirical studies, is a very crude proxy measurement. We attempted to collect data on job characteristics to deal with the heterogeneities; however, we were not able to collect appropriate data about the jobs for all observations used in the analyses. Considering the coefficients for years of schooling and of experience as random ones varying across level 1 units, as we did in the quantitative and multilevel analysis, should be regarded as a beginning in that respect. It could help us to find out that such heterogeneities exist. However, a more detailed

evaluation of the economic benefits attributed to heterogeneity in human capital accumulation across the jobs needs more detailed data about job characteristics and the application of a multilevel of analysis with an extra level of analysis (e.g., a three level model).

Our qualitative analysis also showed that employers provide training and pay for the cost of such investments, in both general and specific training, because such investments are seen as productive. This empirical evidence may apparently contradict Becker's theory of training, which predicts that trainees who recoup the benefits of general training should pay the cost of general training. In fact, it is the employer who recoups the benefits of training and other kinds of investment in human capital, through establishing contracts and an internal labour market that prevent employees from quitting their current firm. Therefore, as Ziderman (1978) states, it is the potential mobility rather than the generality of training, which is the main concern of employers when they finance and provide training. The benefits of spending on human resources through training would justify such firm investment behaviour.

However, almost all respondents highlighted the point that to motivate employees and to benefit from the effects of training on productivity they do share the benefits of training with their employees through promotion and increasing the earnings of employees who receive training. (The results of an earnings function using a sub-sample of observations support this view.) Such benefits would also provide evidence that skills acquired through training are good investments for employees as well.

8.3 Policy Implications

The main policy implications on the issues of investment in human capital in Iran can be summarised as follows:

- (i) Our findings derived from both qualitative and quantitative analyses tend to confirm the productivity-augmenting role of investments in human capital, in general, and education, in particular. It can justify, therefore, investment in human capital by both individuals and society. Unlike most other empirical studies, however, we did not intend to interpret the coefficient of schooling as the rate of return to education for two reasons: (a) the issue of other benefits and direct costs of education, which vary between levels of education and are ignored in the estimates, and (b) the misspecification of the basic Mincerian earnings function for the case of the manufacturing sector of Iran. These imply a caveat about the estimates of the rates of return to education derived from the function for the purpose of policy implications and allocation resources, for example, between investment in human capital or physical capital.⁷
- (ii) Besides education, experience and training were found to be two other important and productive elements of human capital, which are

⁷ Akbari and Ogwang (1996) highlight the same issue for the case of Canada. That is, the results of their study, as they state, question the validity of past policy recommendations based on Mincer type of earnings functions in Canada.

complements to education. It seems, at least for the units of the sector, most training is provided and financed by the employers, which limits the mobility potential of employees. Government can contribute to providing and financing training especially towards the needs of manufacturing units, which have a higher priority. This policy would also help workers to receive training outside their working place that enables them to have more choice to select their future employers. The issue of complementary of education and training also implies that there is room for encouraging technical and vocational education especially at higher education level.

- (iii) It was found that an extra year of schooling at higher level of education increases earnings more in comparison with secondary or primary education. To improve the individual earnings capacity, in particular for the poor, investment in human capital is an important mechanism. It would help the redistribution of income in the society.
- (iv) The varying coefficient structure at the employee level echoes the existence of inequality in both abilities (demand) and opportunities (supply) as well as the quality of education. Evidence as such shows that there is room for government to implement policies for the sake of equity, especially regarding the allocation of educational budget, and quality improvement.
- (v) As the results of the multilevel analysis showed, human capital investments are rewarded differently across the firms. This may be regarded as evidence

on the fact that the economic agents operate under an imperfect competition market which dominates the economy. As economic theory predicts, there is a degree of under-utilisation of resources in the imperfect, in comparison with perfect, competition market. Therefore, encouraging competition among the agents would provide a situation for more efficient use of resources.

- (vi) The variation of effect of education and experience on earnings across firms also implies that investment in human capital is more productive in some economic agents than in others. There is room, therefore, to explore the causes of such higher productivity and to encourage other agents to implement the more appropriate methods of allocation of resources.
- (vii) The application of the new technique of multilevel modelling enabled us, in part, to incorporate the heterogeneity, which is involved in the accumulation of human capital and earnings differentials, in the analyses. The results, in comparison with those of the OLS methodology, provide a rather different explanation of determinants of earnings, and strengthen the explanatory power of human capital theory. In other words, it seems the results are sensitive to the methods of analysis used, which implies that a degree of caution should be made concerning the precision and reliability of estimates, in particular those derived from the OLS techniques.

8.4 Directions for Further Research

- (i) As the findings from the multilevel analysis showed, there is a great degree of heterogeneity in the real world. To study the economic benefits of investment in human capital, especially using data from a nation-wide survey or census, the application of a multilevel method of analysis including other dimensions of heterogeneity, such as jobs, economic sectors, cities, etc., is recommend for further research in the future. Because this technique provides efficient estimates and more detailed explanations, in comparison with a single-level one.

- (ii) As we found the application of both quantitative and qualitative methods very useful to study the key notions of human capital theory, and that these methods are complements, future research can benefit from this complementarity too. That is, qualitative analysis can enrich the quantitative results by exploring the scopes of heterogeneity as well as providing more detailed explanations of the findings. In other words, when one seeks to investigate “*what*” types of question, for example *To what extent does education increase earnings?*, the quantitative methods may be more relevant to provide convincing answers. However, when the purpose of a study is to investigate “*why/how*” types of question, for example *How does education increase earnings?*, the qualitative methods would be more relevant. In the case of human capital analysis of earnings differentials, both

kinds of question are involved. In particular, the question “how does education improve productivity?” merits further investigation in the future.

- (iii) As mentioned earlier, the accumulation of human capital through learning and training on the job varies across jobs, which in turn may create earnings differentials across the jobs. This variation, in fact, reflects a degree of a hierarchical structure. To evaluate economic benefits attributed to (heterogeneity in) human capital accumulation across the jobs more detailed data on the characteristics of job and employing a multilevel of analysis with an extra level of analysis (e.g., a three-level model in which employees are units of level 1, jobs units of level 2 and firms units of level 3) would be essential for future investigation.

- (iv) Conventionally, in the Mincerian earnings function the coefficient for years of schooling is regarded as the rate of return to education, which is assumed to be constant across levels of education. The results of our analyses and those of many other investigations show that such an assumption is not plausible. That is, the findings suggest that the rate varies with levels of education and experience, which indicates that it is unlikely that the coefficient for years of schooling provides an unbiased estimation of return to education. From the viewpoint of policy implications it is essential to evaluate real rates of return to education, which merits further methodological and econometric investigation.

- (v) The evaluation of the economic benefits of training may be of interest especially to the employers. As Becker's training theory predicts and our qualitative analysis shows, employers expect to recoup the benefits of training in the year when training is provided as well as in the future. Therefore, to evaluate the benefits of training programmes, in terms of methodological issues, one has to incorporate both the current and future effects of the investments. Through a longitudinal design it would be possible to have more appropriate estimates in that regard that merits investigating in the future.

- (vi) It seems that internal labour market is an important mechanism whereby employers, for instance, provide motivation for employees to stay at their current work place. It is likely that internal labour market is also a mechanism that provides a better situation for employees to invest in themselves through on-the-job learning and training. This could be another interesting area for further empirical studies, especially through using and conducting qualitative research methods.

- (vii) The analyses in this study were confined to the investigation of determinants of earnings of full-time male employees working in the units of the manufacturing sector. It would be of interest to policy makers to extend the study by including a sample of other manufacturing units (i.e., small size and very large size units), economic sectors, and the self-employed, accompanied with a sample of female employees.

(viii) The multilevel analysis showed that the contextual firm variables partly explain earnings variation across the firms, but a part of earnings variation attributable to firm level still remains unexplained. Therefore, there is room for future studies to investigate the effect of other factors such as productivity growth, technological development, etc. to provide an explanation for the variation of earnings across firms.

8.5 Concluding Comment

This thesis has shown that, in the manufacturing sector of Iranian industry, the amount of education and experience is significantly and systematically associated with the earnings of employees. This helps to corroborate the notion that human capital acquired through education and experience provides individual economic benefits through improving the earning capacity of individuals. These findings are consistent with many other analyses of earnings based on human capital theory. It can be concluded, therefore, that the modern manufacturing sector labour market in Iran functions much like labour markets elsewhere. To the extent that there are differences these are differences of degree and detail, not differences in kind.

This study has also shown that the relatively new statistical technique of multilevel modelling provides a powerful tool for examining earnings differentials and some of the effects of labour market structures on earnings. In general the use of a multilevel model provides evidence for the pecuniary externality effects of human

capital. By treating individual firms as second level units of analysis, it has been shown that part of the differences in earnings can be attributed to the firms in which individuals are working. In particular clusters of highly educated people seem to have a positive effect on the amount of human capital created through experience. It would be interesting to see whether this finding has wider application. The multilevel technique also strengthens the explanatory power of human capital variables.

Information collected from interviews provided some evidence to support the human capital theory interpretation of education rather than pure screening. Although many employers use educational qualification as an indicator of likely ability to do a job and to learn on the job, it is clear that they consider this ability to have been acquired during the process of education rather than as an innate ability.

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Appendix 1: Variable Definitions

Table A1: Variable Definitions

Variable Name	Definition
EDUN	Years of schooling.
EDUN2	Years of schooling squared.
EXP	Years of experience.
EXP2	Years of experience squared.
SX	Years of schooling multiplied by years of experience.
MANG	Managerial position.
HOURS	Hours of work during a year.
SIZE	Size of firm (number of employees).
LOCN	Geographical Location; 1 if the firm located in a big city, 0 otherwise.
SCTR	Sector or Industry; 1 if the firm produces services, 0 otherwise.
AV_S_X	The average of human capital accumulation in each firm (calculated through $(\sum(EDUN_i + EXP_i))/n_j$; where n_j is the number of employees in firm j). For a discussion concerning alternative ways of calculating the average stock of human capital see Table 6.5, page 195, and Table A2 below.
AV_HRS	The average hours of work in each firm.
SSIZE	Years of schooling multiplied by size of firm.
XSIZE	Years of experience multiplied by size of firm.
SLOCN	Years of schooling multiplied by geographical location.
XLOCN	Years of experience multiplied by geographical location.
SSCTR	Years of schooling multiplied by sector or Industry.
XSCTR	Years of experience multiplied by sector or Industry.
SAV_HRS	Years of schooling multiplied by the average hours of work.
XAV_HRS	Years of experience multiplied by the average hours of work.
CONS	Intercept or Constant term.

Table A2: Estimated Effects of Different Methods of Weighting Stock of Human Capital on Employees' Earnings

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β	t-st.	β	t-st.	β	t-st.	β	t-st.	β	t-st.
CONS	7.176	29.6	7.168	33.9	7.208	37.3	7.171	34.3	7.213	37.4
EDUN	0.0132	1.7	0.0135	1.7	0.0135	1.7	0.0134	1.7	0.0135	1.7
EDUN2	0.0011	11.1	0.0011	11.1	0.0011	11.1	0.0011	11.1	0.0011	11.1
EXP	0.0219	18.9	0.0219	18.9	0.0218	18.8	0.0219	18.9	0.0218	19.0
EXP2	-0.0005	-13.2	-0.0005	-13.2	-0.0005	-13.1	-0.0005	-13.2	-0.0005	-13.1
SX	0.00073	10.1	0.00073	10.1	0.0007	10.1	0.00073	10.1	0.0007	10.1
MANG	0.2607	11.6	0.2607	11.6	0.2609	11.7	0.2609	11.7	0.2609	11.7
SIZE	5.0E-05	1.3	4.4E-05	1.1	3.9E-05	1.0	4.3E-05	1.1	3.9E-05	1.0
AV_HRS	-0.0002	-3.1	-0.0002	-3.1	-0.0002	-3.4	-0.0002	-3.3	-0.0002	-3.4
SAV_HRS	-6.5E-06	-2.6	-6.4E-06	-2.3	-6.4E-06	-2.3	-6.4E-06	-2.3	-6.4E-06	-2.3
GAV_SX ^{(1), (4)}	0.6940	2.0								
GAV_SX1 ^{(2), (4)}			0.4678	2.4						
W1AV_SX ^(3,1)					0.01827	2.5				
AV_S_X ^(3,2)							0.01783	2.5		
W2AV_SX ^(3,3)									0.0316	2.5
Level 2:										
cons/cons	0.0329		0.0299		0.0288		0.0298		0.0289	
edun/cons	-0.0008		-0.0007		-0.0007		-0.0007		-0.0007	
edun/edun	8.7E-05		8.4E-05		8.4E-05		8.4E-05		8.4E-05	
exp/cons	-0.00037		-0.00034		-0.00033		-0.00034		-0.00033	
exp/exp	1.1E-05		1.1E-05		9.2E-06		9.4E-06		9.1E-06	
exp2/edun	7.1E-07		6.9E-07		6.9E-07		6.9E-07		7.0E-07	
exp2/exp2	9.6E-09		9.6E-09		9.8E-09		9.6E-09		9.8E-09	
mang/mang	0.01204		0.01204		0.01202		0.01201		0.01202	
Level 1:										
cons/cons	0.0232		0.0232		0.0232		0.0232		0.0232	
edun/cons	-0.0012		-0.0012		-0.0012		-0.0012		-0.0012	
edun/edun	0.0006		0.0006		0.0006		0.0006		0.0006	
exp/cons	-0.0009		-0.0009		-0.0009		-0.0009		-0.0009	
exp/edun	3.0E-05		3.0E-05		3.0E-05		3.0E-05		3.0E-05	
exp/exp	7.7E-05		7.7E-05		7.7E-05		7.7E-05		7.7E-05	
-2*log(lh)	-9801.4		-9803		-9803.4		-9803		-9803.4	

$$(1) \quad \hat{y}_i = \beta_0 + \beta_s S_i + \beta_x X_i$$

$$(2) \quad \hat{y}_i = \beta_0 + \beta_s S_i + \beta_x X_i + \beta_{xx} X_i^2$$

$$(3) \quad \hat{y}_{ij} = \beta_{0j} + \beta_{ips} S_{ij} + \beta_{ss} S_{ij}^2 + \beta_{jyx} X_{ij} + \beta_{jxx} X_{ij}^2 + \beta_{sx} S_{ij} X_{ij} + \beta_{jxm} M_{ij} \\ + \alpha' Z + \beta_{avhr} (AvHrs)_j + \beta_{avs} (AvS)_j + \beta_{avx} (AvX)_j$$

where Z is a vector of firm characteristics (i.e., size, sector and geographical location)

$$(3.1) \quad \Sigma((\beta_{avs} / \beta_{avx}) * EDUN_i + EXP_i) / n_j$$

$$(3.2) \quad \Sigma(EDUN_i + EXP_i) / n_j ; \text{ where it is assumed that } \beta_{avs} = \beta_{avx}$$

$$(3.3) \quad \Sigma((\beta_{avs} / (\beta_{avs} + \beta_{avx})) * EDUN_i + (\beta_{avx} / (\beta_{avs} + \beta_{avx})) * EXP_i) / n_j$$

It should be noted that in the estimated earnings functions presented in tables of chapter 6 it is assumed that average years of schooling in each firm increase earnings of employees as much as average years of experience. To calculate average stock of human capital in each firm, measured by *year*, we used $\Sigma(EDUN_i + EXP_i) / n_j$; where n_j is the number of employees in firm j . This assumption may not necessarily be a satisfactory assumption for different sets of data and the assumption should be supported by empirical evidence. One reasonable way is to use the weighted average stock of human capital. For this purpose, the weighted average stock of human capital can be calculated, for example, through using $\Sigma((\beta_{avs} / \beta_{avx}) * EDUN_i + EXP_i) / n_j$, where β_{avs} and β_{avx} are the contribution of average years of schooling and years of experience on earnings, respectively. By doing this, we found the same results for the coefficient of average stock of human capital, and the coefficients for other variables remain unchanged (Model 3 in comparison with Model 4).

One may adopt another way of weighting; for instance the coefficients for years of schooling and years of experience from the basic Mincerian earnings function (i.e. earnings function (1) or (2)) can be used for the purpose of weighting. That is:

$$(4) \quad \Sigma(\beta_s * EDUN_i + \beta_x * EXP_i) / n_j$$

There are some problems with using this approach:

- i. Depending on the specification of Mincerian earnings function (e.g. earnings function 1 or 2), the estimated coefficients (i.e. β_s and β_x) are different and this will affect the measurement of the variable and in turn the estimated effect of the variable on earnings, as shown in Models 1 and 2.
- ii. The product variable calculated through multiplying the coefficients by years of schooling and years of experience does not have a meaningful scale; it is neither year, month, ..., nor dollars/pounds. As a result, it would be difficult to interpret the results and to make a comparison.
- iii. The estimates of β_s and β_x derived from earnings function (2) are exactly the same for the case of this study. It is expected that the estimated effect of the weighted average stock of human capital on earnings would be the same as the estimated effect of non-weighted average stock of human capital (i.e. the coefficient of "GAV-SX1" of Model 2 in comparison with the coefficient of "AV_S_X" of Model 4). As seen from Models 2 and 4, the coefficients are far from each other because of scaling issue.
- iv. The target variable is a firm level variable and it would be more reasonable to employ weights from the firm level, as suggested in equation (3.1), rather than from employee level.

Therefore, it is more reasonable that the earnings function (3) is estimated for the purpose of weighting, because the function should have been employed for separate evaluation of the effects of average years of schooling and average years of experience on earnings. Nevertheless, since the issue of externality effect of human capital density is of interest to economists and policy makers, it would be interesting to see if there are more appropriate ways of estimating the average stock of human capital embodied in employees in each firm, which merits further investigation.

Appendix 2: Questionnaires for Collecting Data of the Characteristics of Employees and Firms

Dear Sir,

I would be grateful if you would complete the enclosed questionnaires; Questionnaire 1 consists of the characteristics of full-time male employees, and Questionnaire 2 consists of the characteristics of the firm. The questionnaires concern research I am undertaking for my Ph.D. thesis, which examines the relationship between investment in human capital, earnings and productivity.

All responses and data provided will be used only in this study and be treated confidentially. No references will be made which enable respondents and the units to be identified.

I appreciate your help in advance and the results of the study will be made available to you, if you so wish.

Yours sincerely,

Abolghasem Naderi

Questionnaire 2: Firm Characteristics

Number of Employees	Geographical Locality	Major Activity	Products		General Benefits			Annual Revenue	
			Kinds	Quantity	Accommodation	Difficult Atmosphere	Others	Operational	Total

Appendix 3: Questions for Open Interviews

In the semi-structured interviews, to start with, we asked the respondents about the position and significance of candidate's qualifications in recruitment. Then, we intentionally asked specific questions about the issues of education, experience, and training. Our main purpose was to find evidence about the validity (or otherwise) of the productivity-augmenting role of investments in human capital, in general, and education, in particular, as assumed in human capital theory.

Conducting the quantitative analyses of earnings, we found some outliers and that a part of earnings variation remains unexplained. We were also interested in finding out any possible explanation for such patterns from the viewpoint of respondents. Therefore, we asked question about these issues as well. The main questions and issues that were addressed in the interviews for the above mentioned aims are as follows:¹

1. Education

(i) We observe that more highly educated workers/employees are paid more compared to less educated ones, as the figures regarding earnings of your employees show. Could you explain in further detail why the more educated are paid more? Are more educated workers more productive (i.e., are they able to produce more and do they

¹ It should be noted that the extent to which we were able to elaborate the questions and issues varied from interview to interview, because we had no control of time given for the purpose of interviews.

contribute more to the profitability of your firm)? If so, is it the case for all candidates/employees, or in some cases may the more educated not be more productive?

Does education improve the productivity of individuals?

Practically, is it possible to provide any evidence regarding the productivity-augmenting role of education in various jobs involved in the production process?

(ii) Is there any differences among different educational groups (e.g., engineering compared with social sciences) concerning the above mentioned issues? How about the effect of different educational institutions in terms of the quality of schooling?

2. Experience

It is usual to consider experience as another source of accumulation of human capital, as is possibly the case in your company. Could you explain to me the position of experience in connection with the matter of employees' recruitment and their earnings? Considering experience as working years both inside and outside of your company, do such kinds of classification concern you? Is there any significant difference in their contribution to increasing productivity? If so, is there any relationship between the productivity-augmenting role of experience and employees' earnings?

3. Training

(i) Do you have any training programme and policy? If so, could you explain to me the reasons for having such programmes? Do you consider the programmes as a source of updating and improving employees' knowledge and know-how? Do the programmes augment the productivity of trainees? [Any evidence?]

(ii) Do the training programmes affect the trainees' earnings? [If so, is this because of the productivity-augmenting role of training or merely due to the fact that the trainees have participated the programmes? Or ...]

4. Unexplained Part of Earnings Variation and Outliers

(i) After including all variables in an earnings function, on which we were able to collect data, there still remains a part of earnings variation, which is unexplained. Are there any other variables and influencing factors that may account for these earnings differentials?

(ii) We also found that some observations are far removed from the rest of the observations, and show extreme values. In other words, some employees earned too little and some others earned too much in comparison with their counterparts with the same human capital. What are the possible causes of such phenomena?

