

# The Development of On-the-Job Training Theories

----- A Literature Review

by Jinke Yang

(Student ID: 4621243)

Department of Economics of the University of Ottawa  
in partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor Marcel Merette

ECO 7997

December 2008

## **Abstract**

This paper reviews the theoretical and empirical studies of on-the-job training since Gary Becker in the 1960s and tries to point out the research gap between academic studies and policy makers regarding on-the-job training policies, especially in the age of growing international competitiveness and the aging of labor force. Researchers incorporate different factors such as institutional factors, labor and capital markets, employer and employee characteristics into the on-the-job training models and test the models with different datasets. We can see that although the studies are rich, some issues such as public roles in training decisions remain unclear.

## **I. Introduction**

The study of investment in human capital has gained more and more attention in the past few decades, especially since the influential work done by Gary Becker in the 1960s. In Becker's study, human capital can be accumulated in formal institutions and working environment. The latter, which is also known as on-the-job training, is of interest to not only economists, but also policy makers. On-the-job training is also closely related to other labour market phenomena including productivity and wage growth, labour turnover, labour and capital market imperfections, and workplace equity. There are several reasons that may explain why on-the-job training has caught so much attention.

First of all, technological development can be viewed as a "driving force" behind the provision of on-the-job training (Stern and Ritzen 1991: 3). Technologies are undergoing extremely rapid change in the current era in many different areas (ibid: 1). This implies that skills obtained by workers from formal education or previous training and working experience may be obsolete in a short period of time. As Lillard and Tan (1986) point out, skills need to be renewed every 5 to 8 years for an annual depreciation rate of training between 15% to 20% (Lillard and Tan 1986, cited in Ritzen 1991: 193). Training and retraining thus play an important role in renewing workers' skills to catch up with the rapid technological change.

The second reason behind the special attention to on-the-job training is the growing international competition. On-the-job training is critical a nation's international competitiveness (Bishop 1991: 61). Comparative studies of Germany, Japan, and United

States find that German and Japanese firms provide substantially larger amount of on-the-job training and experience a much lower labour turnover rate and fast economic growth in the 1980s (Acemoglu and Pischke 1999; Abe 1994).

Thirdly, the aging of population – a recently appeared phenomenon- has played an important role in the increased attention to investment in human capital, especially on-the-job training. Many industrialized countries now face the problem of aging of population due to the decreased birthrate (Stern and Ritzen 1991: 1, Zeytinoglu et al. 2007). The direct consequence of the aging labour force is skill shortage faced in almost all industries. To be more specific, the gap caused by technological changes, which used to be covered by recruiting more educated young workers, now is more and more difficult due to the decreased birthrate. Thus, it is important for policy makers to remove barriers to the provision of training and to promote “life-long learning and active aging” (McMullin et al. 2004, cited in Zeytinoglu et al. 2007: 3).

Fourthly, from the employees’ perspective, on-the-job training is closely related to the personal development and the growing of employable competitiveness, and thus affects money income (Becker 1964: 1). Jobs require more on-the-job training are usually associated with higher wage growth rate (Bishop 1991: 88). It is important to understand the relationship between on-the-job training and characteristics of employees in order to understand who are more likely to receive training and benefit from it.

Fifthly, on-the-job training relates to a variety of labour market phenomena, such as productivity and wage growth, labour turnover, and market imperfections. The study on-the-job training is important to understand these labour market phenomena, which helps to improve the labour market performance and the social welfare.

Finally, in the current environment, the importance of on-the-job training is growing. It is sometimes acknowledged that on-the-job training is more efficient because of the combination of theory and practice (Stern and Ritzen 1991: 2). Moreover, on-the-job training increases employer's profit and employee's competitive employability and therefore benefits both parties (Zeytinoglu et al. 2007: 3).

In this literature review, attention will be given to studies regarding on-the-job training, both theoretical and empirical. Policy implication of on-the-job training is also reviewed because this issue is also important to policy makers. While most studies stress the importance of on-the-job training, some scholars also argue that training programs are not as efficient and effective as people think and more analytical emphasis should be placed on the cost side rather than the benefit of on-the-job training (Smith 1979: 519). No matter how widely the issue of on-the-job training has been discussed, there still exists some research gap between theories and reality. This paper will try to reveal this gap by reviewing the theoretical and empirical development of studies of on-the-job training.

This paper is divided into the following sections. In section II, I will first review the conventional human capital theory, systematically developed by Gary Becker in the

1960s. In section III, studies on how institutional factor such as minimum wages legislation and union coverage affect on-the-job training decisions will be reviewed. In section IV, the assumptions of perfect markets will be relaxed to encompass studies of training decisions made in the presence of market imperfections. In section V, the roles played by employer and employee characteristics in on-the-job training will be reviewed. Section VI reports the impact of training on productivity and wage growth. In section VII, literatures regarding policy implications, public programs and their evaluations will be reviewed. And in the last section, a brief conclusion will be given to summarize the achievement and research gaps in the literature.

## **II. Conventional Model**

The study of human capital is not new to economists, but the systematic study of human capital theory began only since 1960s. Gary Becker's *Human Capital* can be viewed as the starting point and foundation of human capital theory. In this book, based on the study of on-the-job training, some basic questions about training are discussed, including who bears the training costs and who obtains the returns; how training and turnover affects each other, what is the effect of training on productivity and wage growth (Becker 1964). The conclusion of this study has caught the attention of economists and policy makers. The arguments and extensions of Becker's study form the main streams of human capital theories. In this section, I will first review the main points in Becker's *Human Capital*; arguments around the assumptions and conclusions of this study will then be discussed. In the last paragraph, directions of further studies of human capital theories are summarized.

## **A. Basic Model**

The basic model of current study of human capital theory is developed by Gary Becker in *Human Capital*. In this book, Becker has made some important conclusions, which were “convincing and ha[ve] been influencing not only in the economics literature but also on training policy” (Stevens 1994: 537). Understanding Becker’s theory is the starting point of understanding the development of on-the-job training theory.

The foundation of Becker’s on-the-job training theory is the division and definition of general training and specific training. According to Becker, general training is of use to many other firms besides the training firm, or increases marginal productivity in training firm as well as other firms (Becker 1964: 11-12). Specific training, on the other hand, increased productivity more in training firms (ibid: 18). To facilitate the study, Becker also defines two extreme cases: “perfectly general” training which increases marginal productivity equally in training firm and other firms (ibid: 12-13); “completely specific” training which has no effect on productivity growth to firms other than training firms (ibid: 18).

In the working environment, whether to provide training or not and what type of training to be provided are the joint decision of firms and workers. The incentive to participate in on-the-job training is the possibility of future increase in productivity growth, which benefits both the firms and workers (Becker 1964: 9). Such training will be costly in order to balance the demand and supply. Thus, the crucial question proposed in front of us is how the costs of and returns to on-the-job training should be shared between firms

and workers and what amount of on-the-job training should be chosen, or more generally, how to make training decisions.

Before making the conclusions about general and specific training, it is important to notice that Becker has made some crucial assumptions about labour and product markets (Becker 1964: 9). Both markets have to be perfectly competitive, where marginal products equal wages (ibid: 9). Each period is interrelated with training since current training affects future productivity (ibid: 9-10). Furthermore, Barrett and O'Connell summarized two more conditions for Becker's conventional human capital theory to be valid: perfectly access to the capital market by workers and symmetric information about training programs (Bishop and Kang 1996, cited in Barrett and O'Connell 2001: 649).

Based on above assumptions and definitions, there comes one of the most important conclusions of Becker's work regarding on-the-job training: when training programs are perfectly general, trained workers received the whole returns to general training and will therefore bear the entire costs. There is neither positive externality nor underinvestment in general training (Becker 1964, also summarized in Stevens 1994: 537). Workers pay for general training by receiving wages below their current productivity (Becker 1964: 13).

Less arguable than the conclusion of general training, Becker also makes an important conclusion on specific training too. Generally speaking, returns to and costs of specific training are shared between firms and workers (Becker 1964, also summarized in Stevens

1994: 539). Furthermore, externality that may lead to sub-optimal amount of investment in specific training does not exist since specific training cannot increase workers' productivity in firms other than training firm (Stevens 1994: 539).

Although above conclusions are clear and straightforward, it cannot be used separately from Becker's assumptions, such as perfectly general and / or perfectly specific training programs, perfectly competitive labour and capital markets, and symmetric information about training programs across firms. It is thus important to understand that Becker's theory is more of an idealistic model than an analysis of real world. Becker himself has pointed out in this study that market conditions and the nature of investment are crucial in studying on-the-job training decisions (Becker 1964: 19). For example, monopsony makes training programs more specific while extremely competitive labour markets have fewer specific training available (ibid: 19-20).

When assumptions cannot be met in reality, suboptimal amount of training may occur. According to Becker, the only market imperfection that may cause underinvestment in on-the-job training is liquidity constraint in capital market (Becker 1964: 56-58).

Investment in human capital consists of usually relatively large expenditures with no insurance available in the market. And due to its uncertainty, it is hard to finance and to borrow the needed money from capital market to invest in human capital (ibid). How Becker describes the relationship between capital market imperfections and on-the-job training decisions will be discussed in more details in section IV.

Becker's study on on-the-job training is not limited to the sharing of costs and returns, but encompasses many other labour market issues. According to Becker, on-the-job training plays an important role in defining workers' wage profiles (Becker 1964: 15-16). It is also closely related to the likelihood of labour turnover when skills are specific (Becker 1964: 21-26). Becker's arguments on both issues will be addressed in the related sections.

To sum up, Becker has made some very powerful conclusions in his work *Human Capital* regarding general and specific on-the-job training. The book lays the foundation of all further analysis of on-the-job training. His study not only defines what on-the-job training is, but also indicates how on-the-job training should be carried out. He points out many different factors that may have influence on training decisions and how they affect training decisions. Other than this, Becker also addressed the relationship between on-the-job training and other labour market phenomena, such as workers' wage profiles and the likelihood of labour turnover. All these issues have become the major focuses in the area of human capital theory. In the following paragraphs, some relevant arguments that are frequently mentioned in the literature will be reviewed.

## **B. Relevant Arguments**

Although Becker's on-the-job training theory is fundamental and influential, it left some unresolved puzzles when trying to explain some labour market phenomena. As many studies have pointed out, firms do invest in on-the-job training, even when skills are

general (Stevens 1994: 537). Underinvestment in on-the-job training is considered to be a serious problem and imperfect capital market seems to be unable to explain it.

On the other hand, Becker's work is so influential in the past few decades that literature regarding on-the-job training all takes it as a starting point. Based on the puzzles mentioned above, there are several arguments on the assumptions, definitions, and conclusions of Becker's theory, which have set the main directions of future studies on this issue.

### ***1. Definition of specific/general training***

The first challenge encountered by Becker's on-the-job training theory is the definition of general and specific training. The conclusions can be totally different if different definitions are used. In reality, completely general and specific training cannot be found. On the contrary, most training programs are a mix of the two. Thus, it will be helpful to modify the conventional definition of general and specific training.

In the on-the-job training literature, some scholars tend to widen the range of general training while some tend to widen the range of specific training (Stevens 1994: 538). Becker tends to widen the scope of specific training by arguing that much on-the-job training can be viewed as specific training since it increases workers' productivity more in the training firm (Becker 1964: 18). Ritzen, on the other hand, expands general training by defining it as training that is "of use to at least one other firm" (Ritzen 1991,

cited in Stevens 1994: 538). Stevens argues that Becker's conclusions cannot apply when the starting point has already changed (Stevens 1994: 539).

Some scholars defined new concepts in addition to the general/specific dichotomy in order to explain labour market phenomena. Stevens argues that the contradiction between Becker's prediction and reality can be resolved by introducing a new concept, which he calls "transferable skills". According to Stevens, transferable training refers to training that is useful in at least one firm other than the training firm (Stevens 1994: 540). It is defined to encompass both general and specific training and other forms of training, but it is not always the sum of general and specific training (ibid: 541). Based on this definition, Stevens argue that positive externality exists in the context of imperfect labour markets, which may lead to underinvestment in on-the-job training (ibid: 537).

Ritzen introduces transaction costs into the definition of training, which makes the division of general and specific training depend not only on the content of training, but also on the circumstance (Ritzen 1991: 189). To be more precise, high transaction costs limit the mobility of workers and may turn general skills into specific ones (ibid: 189).

Loewenstein and Spletzer suggest that information about on-the-job training is important in defining general/specific skills. They argue that firms must be able to recognize that a worker's previous training can raise his productivity other than training firm for that training to be general (Loewenstein and Spletzer 1999: 711). When asymmetric

information about training programs exists in the labour market, skills that are in nature general will be transformed effectively into specific ones (ibid).

Surveys also define different forms of training to facilitate data collection. For example, the 1982 Employer Survey in U.S. defines four different types of training: formal training provided by a training professional, time spent watching others to do the job, informal on-the-job training by supervisors, and informal on-the-job training by co-workers (Bishop 1991: 79). Such definition focuses on the forms of on-the-job training rather than the transferability of training content and has been adapted by most empirical surveys. This will be discussed in more details in the following sections.

## ***2. Who pays for the training***

Since on-the-job training can only be obtained at a cost, it is important to understand who bears the costs of training. As summarized above, Becker's theory treats the financing of general and specific training separately and predicts that workers finance the entire costs of general training and share the costs of specific training with their employers. However, these predictions – especially the one regarding general training – contradict to the reality. In the literature of human capital theory, the study of how general training is financed is one the major streams. In fact, Stern and Ritzén view the question “who pays for general training” as a basic question to the conventional human capital theory (Stern and Ritzén 1991: 12).

Becker suggests that profit-maximizing firms do not invest in general training. However, many inconsistencies can be found in reality. For example, the German apprenticeship system provides largely general training but employers pay most of the training costs (Acemoglu and Pischke 1998: 79). Even though apprentices receive relatively low wages thereby paying part of the training costs, a larger portion of the training costs is still borne by the employers (Harhoff 1997). Temporary help firms in U.S. are another example. This type of firm usually provides free basic skills training such as computer skills, typing and other clerical skills (Autor 2001: 1409). Training here serves as a screening process rather than merely provides skills (ibid).

Feuer et al. suggest that firms are willing to finance general training when general and specific training is jointly provided (Feuer et al. 1991: 41-42). The investment then serves as insurance to the returns to on-the-job training, which provides firms with more incentive to invest (ibid: 42). Barron, Berger and Black studies the relationship between the provision of on-the-job training and starting wage in order to find out whether workers pay for training costs through lower starting wages (Barron, Berger and Black 1999). They find no negative relationship between the two factors, which indicates that workers do not finance the training (ibid: 256). Acemoglu and Pischke also suggest that workers usually do not pay for general training, even when they are not credit constrained (Acemoglu and Pischke 1998: 92).

Empirical studies also do not support the conventional theory that workers pay for general on-the-job training by lower starting wages. Loewenstein and Spletzer use

National Longitudinal Survey of Youth (NLSY) dataset of U.S. individuals and find that employers usually bear the costs of general on-the-job training (Loewenstein and Spletzer 1998: 143). Based on two different databases – Small Business Administration (SBA) and Employment Opportunity Pilot Project (EOPP), Barron, Berger and Black find that the impact of general on-the-job training on productivity growth is substantially higher than that on wage growth, which indicates that training firms obtain most of the returns to training (Barron, Berger and Black 1999). This in turn provides firms incentive to invest in general training (ibid). Moreover, they also find that training has insignificant effects on workers' starting wages, which confirms that argument that firms do pay for all, at least most of the costs of general training (ibid).

The share of costs of and returns to general on-the-job training is essential in the study of human capital theory. Extensions and modifications of conventional Becker's on-the-job training theory to explain why firms invest in general training possess a large proportion in the literature of human capital. These extensions and modifications will be reviewed in the following sections.

### ***3. Optimal amount of training***

Another phenomenon that often contradicts the conventional human capital theory relates to the optimal amount of training that should be invested. According to Becker's theory, optimal amount of both general and specific training will be achieved by the private sector itself. The only condition that has to be satisfied is perfect access to the capital market by workers (Becker 1964). However, this is not always true in the real world.

Mincer proposes that there is “no definite evidence of underinvestment, though it cannot be ruled out” through estimating the profitability of investment in on-the-job training (Mincer 1991: 26). Based on the conventional Becker’s theory, Mincer finds that returns to investment in on-the-job training are higher than formal schooling and other forms of investment (ibid: 15). This may indicate a possibility of non-sufficient investment.

Ritzen suggests that underinvestment in on-the-job training may occur due to the uncertainty of its returns (Ritzen 1991: 194-195). In addition, capital market imperfections such as liquidity constraints may also lower the possibility of investment in general training by workers (ibid).

A main stream of studies on on-the-job training focuses on labour market imperfections and how these imperfections affect training decisions. It is widely acknowledged in the literature that underinvestment in on-the-job training exist in the labour market. Thus, it is important to understand the causes of underinvestment and how to improve social welfare by solving this problem.

#### ***4. Training and other labour market phenomena***

On-the-job training is part of the labour market chain. It is related to many other labour market phenomena, such as productivity growth, wage profile, and labour turnover.

Conventional Becker’s theory argues that training is positively related to productivity growth and wage growth, but negatively related to starting wages (Becker 1964). As a result, wage profile is steeper and more concave with on-the-job training (Becker 1964:

15-16). However, this prediction lacks empirical support. Using EOPP, Barron, Berger, and Black find that on-the-job training is not usually associated with a lower starting wage (Barron, Berger and Black 1999: 236) and wage growth appears to be weakly related to on-the-job training, especially compare to the impact on-the-job training has on productivity growth (ibid). Holzer (1990) reports similar results using the EOPP database.

With regard to labour turnover, Becker suggests that the likelihood of labour turnover is only related to specific training (Becker 1964: 21). Since the costs of and returns to specific training are shared between firms and workers, both parties will be hurt by the separation (ibid: 21-22). There is a negatively relationship between the amount of specific training and quit and layoff rates (ibid: 25-26). On the contrary, turnover of general trained workers is not very important to firms (ibid: 24). This proposition has been encountered challenge recently too. Studies on the relationship between labour turnover and on-the-job training will be reviewed later in this article.

### **C. Directions of Further Studies**

Based on the arguments regarding Becker's definitions, assumptions, and conclusions, the directions of further studies in human capital theories also become clearer. Generally speaking, human capital studies after Becker mainly focus on the following directions: the share of costs of and returns to on-the-job training, factors that affect private sector training decisions, relationship between on-the-job training and other labour market phenomena, and compare studies of training patterns in different countries. To better

explain training related labour market phenomena, studies of on-the-job training have focused on different factors such as institutional factors, labour and capital market imperfections, employer and employee characteristics. In the following sections, these directions will be reviewed.

### **III. Institutional Factors**

Institutional factors such as minimum wages legislation and union coverage affect training decisions through changing wage profile or bargaining power. However, their impact is hard to measure and the empirical studies present mix results. In this section, I will first review studies of relationship between training and minimum wages and then training and union coverage.

#### **A. Minimum Wage Legislation**

Conventional human capital theory suggests that minimum wage is negatively related to the investment in on-the-job training. When workers' initial productivity is lower or equal to the minimum wage, they cannot pay for on-the-job training as they are not allowed to accept wages lower than the productivity (Becker 1964). Moreover, lower end workers protected by the minimum wage legislations are those who need most training. The presence of the minimum wage will inevitably lead to underinvestment in on-the-job training, especially general training (ibid).

Simpson (1984) and Bishop (1991) propose similar arguments as the conventional human capital theory developed by Becker. Bishop's empirical results show that the existence of

minimum wages legislation lowers training investment substantially, roughly 17 percent based on a longitudinal survey of 3, 412 employers in United States (Bishop 1991: 63, 94). While the empirical results of Simpson's study do not support the negative relationship between minimum wage and training (Simpson 1984: 450), this may be caused by sample bias. That is, while minimum wages legislation mainly focuses on young workers, Human Resources Survey of the Economic Council of Canada used in this study does not distinguish among different age groups (ibid: 450).

Hashimoto (1982) argues that minimum wage legislation lowers training opportunities for workers in two ways: loss of employment of some workers and a reduction in training opportunities for remained workers (Hashimoto 1982: 1071). Furthermore, the decrease in the rate of employment and the amount of on-the-job training caused by minimum wages legislation is a loss for both employers and employees (ibid: 1075). Empirical results support Hashimoto's prediction, which further indicates a flatter wage profile due to the reduction of training (ibid: 1081).

Leighton and Mincer study the effects of minimum wages on formal schooling and on-the-job training separately. They argue that the negative relationship between minimum wages and on-the-job training is unambiguous while the relationship between minimum wages and formal schooling is unclear (Leighton and Mincer 1981: 155). According to Leighton and Mincer's argument, minimum wages legislation sets barriers to on-the-job training because it precludes the possibility for workers to finance the training through lower starting wages (ibid: 158).

In contrast to the above studies, Grossberg and Sicilian (1997) find no relationship between minimum wages and training, but wage growth is lower for minimum wage workers (Grossberg and Sicilian 1997, cited in Acemoglu and Pischke 1999b: F130). Acemoglu and Pischke also argue that the presence of minimum wages compresses the wage structure and increases the investment in general job training (Acemoglu and Pischke 1999b: F124-125). They predict that minimum wages will increase the amount of firm-sponsored training but flatten the age-earnings profile of workers (ibid: F130).

## **B. Union Coverage**

Effects of union coverage on on-the-job training are more difficult to evaluate than those of minimum wage since union coverage is hard to measure. Barron, Fuess and Loewenstein suggest that union reduces the amount of on-the-job training (Barron, Fuess and Loewenstein 1987). By dividing training into management-provided training and worker-provided training, Barron et al. find that the degree of unionization and the amount of on-the-job training provided by firms are negatively related (Barron, Fuess and Loewenstein 1987: 637). They also find that unionization relates to higher starting wages (ibid: 637), which according to the conventional Becker's theory will also reduce the opportunity of on-the-job training.

Frazis, Gittleman and Joyce have similar findings: union coverage and job training are negatively related, both training provided and received (Frazis et al. 2000: 452). The negative impacts of union are on both the incidence and intensity of formal training (ibid: 455). However, in another study, Frazis, Herz and Horrigan find a positive relationship

between union coverage and formal job training (Frazis et al. 1995: 14), although the relationship is not statistically significant (ibid: 15). They also claim that most previous studies suggest that the presence of a union is associated with more job training because of lower turnover rate (ibid: 12).

Booth and Chatterji argue that unionized firms provide more training and higher wage under union's bargaining power (Booth and Chatterji 1998: 338). Their model predicts that the more bargaining power possessed by unions, the higher the wages of trained workers and the lower the possibility of labour turnover (ibid: 340). According to Booth and Chatterji, union power is used to overcome the monopsony power of firm in wage determination and to ensure effective long-term contracts between firms and workers (ibid). To sum up, the presence of union is associated with an increase in firm provided training (ibid).

Weiss analyzes this issue from another perspective as he argues that on-the-job training may be imposed on new workers by senior union members (Weiss 1985: 994). In the short run, there may be overtraining for new workers through the impact of a union dominated by senior workers as a form of entrant cost (ibid: 994). However, training will be at efficient level in the long run (ibid: 995). It needs to be noticed that unions here refer to specifically craft unions and professional associations (ibid: 994).

Some studies of union and job training find no significant relationship between the two factors. Simpson argues that the lack of statistically significant relationship between

union and on-the-job training is due to the complexity of unions (Simpson 1984: 450). Lynch and Black also find union has no significant impact on training decisions (Lynch and Black 1998).

#### **IV. Labour and Capital Market**

Some empirical studies find that at least two training related phenomena contradict the conventional Becker's predictions. One is the provision of general on-the-job training by firms, and the other is the underinvestment in on-the-job training. These may be due to some forms of market imperfections. Conventional theory argues that labour market failure that leads to underinvestment in on-the-job training does not exist (Becker 1964, also cited in Acemoglu and Pischke 1999b: F113). Only credit constraints of workers may cause underinvestment in training (ibid). Stern and Ritzen argue that uncertainty about the future returns to training investment and liquidity constraints on workers will cause underinvestment in on-the-job training (ibid: 2). These two phenomena indicate that some forms of labour market and capital market imperfections exist. Generally speaking, studies on market imperfections and on-the-job training can be divided into two major directions, one direction focuses on labour market imperfections, and the other focuses on capital market imperfections.

##### **A. Labour Market**

There exist many forms of labour market imperfections such as transaction costs of labour mobility, adverse selection, information asymmetries, and compressed wage

structure. They affect training decisions from different perspective and have different impacts.

Hashimoto directly extends the conventional Becker's theory by focusing on the share of costs and returns of specific on-the-job training (Hashimoto 1981). Information about a worker's post-training productivity is important in Hashimoto's sharing model since returns to training investment are uncertain (Hashimoto 1981: 475). Similar to the conventional model, Hashimoto suggests that both training firms and post-training workers will be hurt by their separation (ibid). The existence of transaction costs, which lowers the possibility of labour turnover, provides incentives for both firms and workers to share the costs of and returns to specific job training (ibid).

Imperfect labour market affects not only firm specific training decisions, but also general training decisions, and the impact on the latter is even stronger. As Bishop argues, labour market with information asymmetries tends to treat general skills as specific ones (Bishop 1991: 91). Information asymmetry is an important form of labour market failure when making training decisions.

Katz and Ziderman are the first to propose that firms may invest in general training if these training programs cannot be observed by other firms (Acemoglu and Pischke 1998: 82). Katz and Ziderman argue that transaction costs exist because of information asymmetries (Katz and Ziderman 1990: 1147). The asymmetries exist between training firms and outside firms, and also exist between trained workers and potential hiring firms

(ibid: 1147-8). Generally speaking, trained workers are more valuable to training firms because they know more about the general and specific training workers have (ibid). This provides incentive for firms to finance at least part of the general on-the-job training (Katz and Ziderman 1990: 1148). On the other hand, hiring new workers is costly to a firm because different positions may require workers that possess different packages of general skills (ibid: 1150-1151). The information gap regarding workers general skills may reduce the possibility of moving across firms for generally trained workers since the value of their training cannot be fully observed by hiring firms (ibid: 1152). As a result, firms will share a larger proportion of general training costs if the information is more asymmetric between training firms and hiring firms (Katz and Ziderman 1990: 1153-1154). Katz and Ziderman also point out that certification, which tends to make training programs more visible to hiring firms, may actually reduce the investment in general training (ibid: 1157). Firms will be less likely to share the costs of general training when it can be easily signalled to hiring firms and this increases the financial burden of workers (ibid: 1157).

Bishop argues that imperfect labour market tends to treat general skills as specific ones (Bishop 1991: 91). In other words, a set of skills may be more valuable to the training firms because each firm requires different sets of general skills and information about workers previous skills is not available in the labour market (ibid: 91). When general training programs are not perfectly visible to outside firms, the market wages for post-training workers will be lowered (ibid: 94). In this situation, training firms have more bargaining power than post-training workers in determining wages and are able to reap

part of the returns to general training. It is thus reasonable to predict that costs and returns of investment in general training will be shared by firms and workers (ibid: 94).

Chang and Wang (1995) argue that workers with lower productivity have higher probability of separation and thus lower the market of value for workers in the second-hand labour market (Chang and Wang 1995: 95). Consequently, market wage for job-changing workers is lower because of adverse selection problem, as they are perceived with lower productivity (ibid: 92-93). Market wage of job-changing workers is also positively related to labour turnover (ibid: 97-98). When market wage for job-changing workers is low as predicted, workers tend to invest more in on-the-job training in order to lower the possibility of separation with current firms (ibid: 98).

Chang and Wang (1996) argue that information asymmetry may distort human capital investment and thus further affects labour turnover and wages (Chang and Wang 1996: 505). Information asymmetric over the amount of human capital accumulated by workers causes the negative relationship between turnover and both general and specific training (ibid: 507). This distortion in training investment can be divided into two components: one is “externality distortion” where market does not recognize the level of training possessed by workers (Chang and Wang 1996: 514); the other is “sharing distortion” where the returns to general training investment are shared between firms and workers (ibid). They argue that underinvestment is more severe when training is general because incentive for firms to invest in specific training is stronger<sup>1</sup> (ibid: 505-507).

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<sup>1</sup> Chang and Wang argue that when information is symmetric, investment in general training will be higher because its market value is higher than specific training (Chang and Wang 1996: 507). However, when

Acemoglu and Pischke (1998)'s model is based on adverse selection in the labour market. Quit and layoff workers cannot be distinguished in the second-hand labour market but it is reasonable for potential recruiting firms to assume that most of them are less able than the workers remain in the training firm (ibid: 80-81). Turnover rate is negatively related to the amount of training (ibid). Based on adverse selection and asymmetric information in the labour market, two equilibria may be achieved: high training with low turnover rate and low training with high turnover rate (ibid: 81).

Stevens' model predicts that the private return to training investment is lower than the social return, which indicates underinvestment in on-the-job training (Stevens 1994: 545). The concept of "transferable skill"<sup>2</sup> is introduced in his analysis. However, when training is more transferable, social return is greater and private return to each firm is less, while return to trained workers increases (ibid: 554). Both training firms and other firms can obtain some returns to the training investment (Stevens 1994: 557). Firms have incentives to invest in transferable training but the amount is less than the optimal level (ibid).

Ritzen argues that labour market imperfections such as unobservable individual abilities and unknown financial returns, cause uncertainty about the financial returns to training investment (Ritzen 1991). Moreover, unlike other market uncertainties, no insurance is available in the market to cover the possible loss to this investment (ibid). For risk neutral firms and workers, neither party will be willing to pay entirely for the costs of on-the-job

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information is asymmetric, the incentive for firms to invest in firm specific training is stronger than the incentive to invest in general training (ibid).

<sup>2</sup> "Transferable skill" refers to skill that is useful to at least one firm other than the training firm (Stevens 1994: 540).

training, at least not at the optimal level (Ritzen 1991). As a result, the costs and returns to on-the-job training are shared between firms and workers even when skills are general (Ritzen 1991: 189-190).

Acemoglu and Pischke argue that labour market imperfections compress the wage structure (Acemoglu and Pischke 1999a, 1999b). Consequently, firms will be willing to bear some or perhaps all of the on-the-job training costs (Acemoglu and Pischke 1999a: 542). According to Acemoglu and Pischke, the market wage distortion is caused by “search-induced monopsony” and asymmetric information (ibid: 556-557). Therefore, it is costly for trained workers to change jobs because of their low bargaining power with potential employers and the possibility of unemployment (ibid: 556). Furthermore, the costs increase with skills (ibid).

The key concept of Loewenstein and Spletzer’s study is “contracting restrictions”, which means a guarantee future wage when hiring that prevents the employer from obtain too much from the returns to training investments and thus lowers the quit rate of post-training workers (Loewenstein and Spletzer 1998: 167). Their model predicts that the employer will be wiling to bear the cost of general and specific on-the-job training if he can profit either directly or indirectly from providing the training (ibid: 155). The employer can profit indirectly since training lowers the probability of quit (ibid). The fact that employers are willing to share the costs of and returns to general and specific on-the-job training in real world is due to “contracting restrictions” (ibid: 155). Empirical results based on the NLSY dataset show that employers do pay for large proportion of direct

training costs (Loewenstein and Spletzer 1998: 158). Even when skills are very general, employers still bear about 40% of the training costs according to the dataset (ibid).

## **B. Capital Market**

Becker argues that it is hard to borrow money to invest in human capital (Becker 1964: 56-57). Bishop also argues that liquidity constraint is one of the causes why firms provide general on-the-job training and reap a large part of the returns (Bishop 1991: 91, 94).

Ritzen proposes similar arguments as Becker and Bishop. He suggests that capital market imperfections, especially credit constraints of individuals, are the main causes of underinvestment in general training (Ritzen 1991: 199). Ritzen and Stern argues that the problem of underinvestment in general training is especially serious for low income workers since they have more difficulties in financing the costs of general training while they have imperfect access to the loan market (Stern and Ritzen 1991: 4). Ritzen and Stern also point out the financial risk of investment in general training because future returns to such investment is uncertain and cannot be insured (Ritzen 1991: 186-188; Ritzen and Stern 1991: 3). The lack of available insurance may be due to the fear of “moral hazard” and the probability of adverse selection (Ritzen and Stern 1991: 4). However, liquidity constraint is not always viewed as an obstacle to training investment. Katz and Ziderman argue that with the presence of information asymmetry, liquidity constraints will not totally block the investment in general training (Katz and Ziderman 1990: 1155). To be more precise, when information of training program is asymmetric between training firm and recruiting firm, the firms will have incentive in sharing the

costs of general training (ibid). In this situation, workers only have to finance their portion of the costs of general training, which reduce the probability of facing liquidity constraints (ibid: 1155).

## **V. Employer and Employee Characteristics**

Studies of how institutional factors and labour and capital markets affect on-the-job training decisions tend to use a relatively more macro perspectives. On the other hand, some studies tend to focus on the micro determinants of training decisions, i.e. employer and employee characteristics such as firm size, industries, turnover rate, workers' age, education, gender, and ethnic. Since data regarding these factors are more accessible, empirical studies in this area are fruitful.

### **A. Employer Characteristics**

Employer characteristics include firm size, turnover rate, industries, and the rate of technological change. They all play important roles in making training decisions. I will review them in turn, but first start with more comprehensive studies.

#### ***1. Comprehensive Studies***

Bartel identifies four determinants of the provision of on-the-job training: degree of technological change, average tenure of workers, size of firms, and product competition (Bartel 1991: 114-115). He predicts that firms that are larger, have higher degree of technological change, provide longer tenure to their workers, and facing more domestic and international competition tend to provide more on-the-job training, especially formal

training. The empirical results based on the Columbia Business School Human Resources Survey generally support these predictions (Bartel 1991: 119-120).

Frazis et al. (1995)'s empirical results show that firm size and tenure are both positively related to the provision of formal training (Frazis et al. 1995: 5, 10). The type of industry is also closely related to the level of training (ibid: 5). According to this study, finance, insurance, and real estate sectors provide more job training (ibid: 10).

Frazis et al. use the 1995 Survey of Employer-Provided Training (SEPT95). This survey measures not only the incidence but also the intensity of training. It covers both employers and employee' responses, and measures both formal and informal training (Frazis et al. 2000: 443-444). The study finds that firms that provide more benefits and have faster technological development are more likely to provide job training and invest more hours in training (ibid: 451-454). Turnover rate decreases the probability of receiving training by workers, but not training provided (ibid: 453). Size of firms has different training effects from the perspectives of employer and employee. Larger firms are more likely to provide formal job training, but workers in larger firms do not report that they receive more training than those in smaller firms (Frazis et al. 2000: 452). Moreover, hours of training provided and received do not positively related to firm size (ibid: 455), which indicates that the impact of firm size on training may be indirect (ibid: 459). The proportion of part-time workers also affects training decisions. Larger proportion of part-time workers is negatively related to training provided but not related to training received (ibid: 452).

Lynch and Black also try to find out the determinants of employer-provided training (Lynch and Black 1998: 65). They stress not only incidence of training, but also the content of training programs (ibid). Several factors are examined in this study: size of firms, investment in physical capital, industry, and turnover rate (Lynch and Black 1998). Lynch and Black chose the Educational Quality of the Workforce National Employers Survey (EQW-NES) as their database and find that the provision of formal training is positively related to firm size and negatively related to the turnover rate (ibid: 65-73). The relationship between investment in physical capital and on-the-job training is unclear (ibid: 66). When two forms of investment are substitute to each other, the relationship will be negative. On the contrary, when investment in physical capital and human capital are complimentary, they are positively related (ibid). The empirical result of Lynch and Black seems to support the latter argument (ibid: 69). The type of industry also plays an important role in the provision of job training. Non-manufacturing sectors such as communication, finance, and insurance are more likely to offer formal employer-provided training (ibid: 69).

## ***2. Size of establishments***

The relationship between size of establishments and provision of on-the-job training is relatively consistent in the empirical studies. Larger firms usually tend to provide more training, especially formal training to their employees. However, the explanations of this positive relationship vary.

Ritzen suggests that the existence of internal labour market within larger firms effectively turns most training specific (Ritzen 1991: 194). As a result, larger firms are more likely to offer employer-provided training as compared to small firms (ibid: 194). However, Ritzen also points out that the higher level of training in larger firms may also be due to lower turnover rate and/or their ability to take more risks (ibid).

Using the Human Resource Survey database, Simpson finds that larger firms provide more specific training but not general training (Simpson 1984: 447). This supports the argument that larger firms are able to develop internal labour markets that facilitate on-the-job training (ibid).

Bishop argues that size of firms and investment in on-the-job training have a “curvilinear” relationship rather than simple positive relationship (Bishop 1991: 69). Training is provided most in large than in small firms, and least in medium firms (ibid: 94). Bishop points out that lower turnover rate, better access to capital markets, higher return to training, and greater effect of training on lowering turnover rate in large firms are the reasons why large firms provide the most on-the-job training (ibid).

Size of firms not only affects training decisions directly, but also affects training via other factors. Barron, Black and Loewenstein argue that size of firms, the hiring process, and on-the-job training are interrelated (Barron, Black and Loewenstein 1987). The monitoring cost in larger firms may be reduced through a more intensive hiring process. Thus, larger firms are able to hire workers of greater ability (ibid: 84). Moreover, when

the hiring process is intensive, layoffs and quits become more costly to larger firms. As a result, larger firms tend to provide more training because the workers are more competent due to the high hiring and firing costs (Barron, Black and Loewenstein 1987).

Holtmann and Idson suggest that larger firms behave differently from smaller firms in training because of “the risk component of the investments in their employees” (Holtmann and Idson 1991: 339). This approach helps to understand not only the relationship between size of firms and provision of training, but also on the way resources of on-the-job training are divided among different groups of workers (ibid: 330-340). The model predicts that the possibility of receiving on-the-job training is positively related to the expected returns to training investment and negatively related to the risk of returns (ibid: 344). Larger firms tend to provide more on-the-job training because returns to training are higher and risk is lower (ibid). The empirical results support the hypothesis (ibid: 346-347).

In contrast to the above papers, Zeytinoglu and Cooke show that workers in smaller workplaces have more opportunities to receive on-the-job training since schedule and forms of training are more flexible (Zeytinoglu and Cooke 2006, cited in Zeytinoglu et al. 2007: 5).

### ***3. Turnover***

According to the conventional Becker’s theory, turnover is only related to specific training. General training and turnover training can be analyzed separately since it is the

employee who finances the entire cost and obtains the returns (Becker 1964). However, this separation cannot be applied when information on the labour market is asymmetric. Chang and Wang suggest that investment in human capital, turnover, and wage rates are closely related under asymmetries of information (Chang and Wang 1996: 505).

According to Greenwald, in the presence of adverse selection in labour market, potential firms are less likely to hire workers from the job-changing pool while job-changing workers face lower market wages (Greenwald 1986: 325). Since current firms know more about their workers, they will make more efforts on keeping the abler ones (ibid: 325). As a result, workers' mobility in labour market is constrained. This phenomenon affects social welfare in two offsetting ways: on one hand, it may reduce social welfare since job matching cannot be improved (ibid: 342); on the other hand, lower turnover rate may increase the possibility of firm-sponsored training and thus increase social welfare (ibid: 325).

Chang and Wang argue that turnover is negatively related to the amount of investment spends on general (Chang and Wang 1995: 97-98) and specific training (Chang and Wang 1996: 507) because of information asymmetries over training programs. Acemoglu and Pischke suggest that training and turnover affects each other and two equilibria can be achieved (Acemoglu and Pischke 1998): high training-low turnover and low training-high turnover (ibid: 90-91). They provide the U.S. and Germany as examples. The U.S. has a higher turnover rate and lower investment in training, when Germany has higher investment in training and a lower turnover rate (Acemoglu and Pischke 1999a: 549).

Bishop argues that turnover is important to training decisions because the labour market imperfections transforms general training into specific training, where costs of and returns to the training investment are shared between employers and employees (Bishop 1991: 95). If this is true, the relatively higher turnover rate in the United States partly explains why training investment in the United States is lower than in Japan and Germany (ibid). The higher turnover rate in the United States may due to its hiring process and imperfect information (ibid).

However, the negative relationship between turnover rate and investment in on-the-job training is not a unanimous finding. Simpson shows that a higher turnover rate can be associated with more general training (Simpson 1984: 446). Simpson argues that turnover increases the market value of general training because the skills can be used in both training firms and other firms (ibid). On the other hand, specific training may be deterred by turnover since the separation may cause some loss for the provider and receiver of specific training (ibid).

## **B. Employee Characteristics**

The characteristics of employees also affect training decisions but from a different perspective. The employee characteristics mainly affect how training resources are allocated among different demographic groups. Training barriers exist for some traditionally vulnerable groups, such as older, female, and visible minority workers.

### ***1. Comprehensive studies***

There is evidence that suggests that young, white males in U.S. are more likely to receive firm provided training (Mincer 1983, 1991; Barron, Black and Loewenstein 1987; Barron et al. 1989). Training also tends to increase with education level (Bartel 1991; Lynch and Black 1998; Frazis et al. 2000). Underinvestment in training is most likely for older and less educated workers (Stern and Ritzen 1991: 1).

Using the Columbia Business School Human Resources Survey, Bartel divides individuals into different professional groups (Bartel 1991: 106-107). Bartel finds that age is negatively related to the probability of receiving training, while education is positively related to it. White males are more likely to receive training than black males and white and black females (ibid: 102).

Altonji and Spletzer study the relationship between employee characteristics and on-the-job training using data from the National Longitudinal Survey (NLS) of High School Class of 1972 (Altonji and Spletzer 1991). The incidence of receiving training and the amount of training received are examined separately. The main conclusion is that the incidence of receiving training is higher for women than for men but men receive larger amount of training (ibid: 63-65). Blacks receive more training than whites, both training incidence and training quantity (ibid: 65, 75). Education is positively related to the provision of on-the-job training and the relationship is statistically related (ibid: 68). However, a larger proportion of the relationship can be explained by the differences in workers' aptitude and achievement and by the fact that more educated workers are usually assigned to jobs require more on-the-job training (ibid: 68, 75).

Bishop (1991) finds that professional, managerial, and non-retail sales require the most training in the first three months of the employment (Bishop 1991: 66-68). Work experience and education are both positively related to training (ibid: 71-72). The explanation behind this relationship is straightforward. Workers with more relevant work experience are more productive and thus cost less to be trained (ibid). More educated individuals are selected to fill positions that require more training because they are considered to have higher learning ability (ibid: 71). The relationship between age and training is curvilinear according to Bishop. Teenagers receive less training than the 25-29 year old group, while workers over forty receive the least amount of training (ibid).

Lynch finds that female receive more formal education and off-job training but less on-the-job training compared to male (Lynch 1992: 302). Non-whites receive lower wages than white male and participate in fewer on-the-job training programs (ibid). Both education and worker experience are positively related to on-the-job training but the effect of education on training differs as level of education differs (ibid: 303). To be more precise, high school education has the strongest positive relation with on-the-job training and the relation is weaker for college and university education (ibid). Probabilities of receiving on-the-job training are also related to tenure with current employer and training received before (ibid: 304-305).

From the above review, the empirical results regarding employee characteristics are pretty consistent. Education, work experience, and tenure are positively related to training while age is negatively related to it. Vulnerable groups such as female, minority, and

aged workers have less opportunity of receiving training. In the current era, three factors need special attention: age, gender and ethnic. This is due to the ageing of population and possible workplace discrimination. In the following paragraphs, I will review studies on these three factors in more detail.

## *2. Age*

As Barron, Black and Loewenstein (1989) have noticed, on-the-job training plays an important role in the early months of employment and /or entry level positions. These groups are mainly composed of younger individuals. Inevitably, studies that examine on-the-job training mainly focus on these workers. This indicates that older workers are ignored in both training policies and academic studies. In the age of skill shortages and the aging of labour force, training and retraining of older workers deserve special attention.

Zeytinoglu et al. find that the opportunity of receiving on-the-job training declines with age (Zeytinoglu et al. 2007: 4). Previous studies point out several barriers to on-the-job training facing by older workers (ibid). The barriers include employers' negative perceptions about older workers' capabilities and the reluctance of older workers to seek training opportunities (ibid). According to the definition of Canada Workplace and Employee Survey (WES), about 20% of workers are considered to be old (ibid: 10). During the year, 24% of older workers received on-the-job training while 37% young workers and 34% middle-age workers received on-the-job training (ibid). Empirical results suggest that older workers have less training opportunities than their younger

counterparts, although training level is already low for the entire workforce (Zeytinoglu et al. 2007).

Returns to training decline with age as well (Mincer 1991). The effect of training on wage growth is about 9.5% at younger ages but is only 3.6% for older workers (Mincer 1991: 21).

The lack of training opportunities for older workers should ring a bell for policy makers in the current environment. It is important to stress training and retraining for older workers when making training decisions in order to maintain a dynamic and competitive labour force.

### ***3. Gender and Ethnic***

Booth finds that male and female exhibit several differences in training behavior (Booth 1991). For male, the longer of being unemployed, the lower the possibility of receiving on-the-job training (ibid: 285). Secondly, part-time status has significantly negative impact for women but not for men (ibid). Thirdly, larger firms increase training probability only for women but not for men (ibid: 287). Fourthly, when formal schooling and training are complementary, education increases the possibility of training for both men and women (ibid: 291). Finally, ethnic is insignificant in receiving on-the-job training for both men and women (ibid: 285).

Hum and Simpson use the Adult Education and Training Survey (AETS) database, which distinguishes immigrants since 1998. Previous studies suggest that immigrants may face some difficulties in on-the-job training, especially when they have language problems (Hum and Simpson 2003: 471-472). Combined immigrant status and other individual characteristics, Hum and Simpson find that the gap of training incidence and duration is larger for male between immigrants and native-born, but less apparent for female (ibid: 437). Age is negatively related to the possibility of receiving training among immigrants while education and working hours are positively related to training (ibid: 478). Adult immigrants receive significantly less training than children immigrants (ibid: 487). Hum and Simpson also point out the barriers to training for immigrants, which include financial constraints for both male and female immigrants and difficulties in recognizing previous education and experience for female immigrants (ibid).

Duncan and Hoffman study training and its effects on earnings using data Panel Study of Income Dynamic (PSID) (Duncan and Hoffman 1979). They divide workers into four demographic groups: white male, black male, white female, and black female. Empirical results show that professional, technical workers and managers require the most on-the-job training (ibid: 597). White males hold positions that require at least twice as much training as other groups (ibid: 598). The proportion being trained is also highest among white males and lowest among black males and females (ibid). Returns to investment in human capital are approximately the same among the four groups (ibid: 601) and thus no direct discrimination can be observed (ibid: 596). However, Duncan and Hoffman argue that the possibility of discrimination cannot be ruled out because there may be entry

discrimination which assigned jobs to black males and white and black females that require much less training (ibid: 597-598).

## **VI. Training, Productivity Growth and Wage Profile**

According to Becker's theory, both general and specific training increase workers' productivity. Workers' wage growth equals to the productivity growth when training is general and is lower than the productivity growth when training is specific (Becker 1964). Workers finance the entire costs of general training and part of the costs of specific training through starting wages lower than their productivity (ibid). As a result, on-the-job training is associated with steeper and concave age-earning profiles (Becker 1964: 59).

Since on-the-job training is closely related to productivity and earnings, many studies try to explain productivity difference and earnings disparity among different demographic groups through their different opportunities in receiving on-the-job training. These studies are reviewed in this section.

Bishop argues that the rate of wage growth is higher for jobs requiring more on-the-job training (Bishop 1991: 88), which indicates a positive relationship between wage growth and on-the-job training. However, Bishop also points out that the impact of training on wage growth is much smaller than on productivity growth, even though most of the training programs are general rather than specific (ibid: 90). Bishop explains the contradiction with conventional theory by arguing that general skills are not treated as

general in the labour market due to market imperfections (ibid: 91). As a result, returns to training investment are shared between firms and workers and firms profit from the difference between productivity growth and wage growth (Bishop 1991). To sum up, Bishop concludes that general training has stronger impact on wage growth than specific training, but the impact on productivity growth is even larger than on wage growth (ibid: 94).

The positive relationship between wage growth and on-the-job training is supported by some empirical studies. Using the Employment Opportunity Pilot Project (EOPP) survey, Loewenstein and Spletzer found that wage is positively related to on-the-job training (Loewenstein and Spletzer 1999: 720). Relevant work experience, which measures skills obtained from previous jobs, is also positively related to wage (ibid). This indicates that most training provided by firms is general and can be recognized by other firms (ibid).

The conventional theory also predicts that training is negatively related to starting wages, but this prediction does not have much empirical support. Barron, Black and Loewenstein (1989) find that the relationship between starting wage and training is not clear (Barron, Black and Loewenstein 1989: 6). They find that training and wage growth is positively related, but previous working experience has a negative impact on wage growth (ibid: 6-7). Training increases productivity growth more than wage growth (ibid: 10). They find that a 10% increase in training will increase productivity growth by 3%, but increase wage growth by only 1.5% (ibid: 7, 10).

Using the EOPP and Small Business Administration (SBA) databases, Barron, Berger and Black also cannot find support for the negative relationship between on-the-job training and starting wages (Barron, Berger and Black 1999: 242). However, when taking workers' ability into consideration, the negative impact of on-the-job training on starting wages is more obvious (ibid: 244). Barron et al. also study the relationship between training and productivity and wage growth. Using the SBA and EOPP datasets, they find that wage growth of worker is not strongly related to on-the-job training, while productivity growth has strong positive relationship with on-the-job training (Barron, Berger and Black 1999: 250). This indicates that most of the returns to on-the-job training are taken by training firms (ibid: 250), which also explains why firms bear most of the costs of training (ibid). There are several possible explanations, such as information asymmetries about training programs or the fact training costs maybe paid in some later date outside the database (ibid: 250-251).

Lynch tries to understand how the wages of young workers are determined and studies the role of tenure, work experience, schooling, and training in wage determination (Lynch 1992: 305). She finds that training is important in wage determination in all occupations in this study, especially training provided by current firms (ibid: 306-307). On the contrary, training experience from previous firms has no significant impact on current wages (ibid: 307). Lynch finds that race and gender plays an important role in receiving on-the-job training, as reviewed in section V. Since on-the-job training is positively related to wage growth, low probabilities of receiving training by female and

nonwhites may be a plausible explanation of the wage gap between female and male, nonwhites and whites (ibid: 311).

## **VII. Policy Implications**

According to Becker, an optimal level of both general and specific training can be achieved by the private market itself (Becker 1964). Later studies largely reject this prediction. Although not all scholars find definite evidence of underinvestment in on-the-job training, it is widely accepted that labour and capital markets are not perfect for providing on-the-job training. In other words, an optimal level of training usually cannot be achieved by private sector decisions. The existence of market failures in providing on-the-job training is the rationale behind public intervention (Hansen 1991). As Hansen has summarized, market failures behind training provision include externalities, information asymmetries, resource immobility, and distribution inequality in income and wealth (Hansen 1991: 219).

Stern and Ritzen also claim that private sector itself cannot achieve the optimal amount of on-the-job training because of some market imperfections (Stern and Ritzen 1991: 1). The return to training investments is higher than other forms of investments and that some groups of workers are more likely to be ignored in private training decisions (ibid). Stern and Ritzen suggest that public intervention should base on the causes of market failure (ibid: 6). For example, public role should focus on making training programs more transparent in the labour market when suboptimal training decisions are caused by

information asymmetries (Ritzen 1991: 6-7); guaranteed wage increases after training may be helpful when uncertainty about training returns exist (ibid: 8).

Ritzen strongly recommended a more extensive role of public with regard to on-the-job general training (Ritzen 1991). Ritzen proposes two public schemes to reduce workers' risk in investment in general training: "inverse insurance" which directly subsidize the training costs through tax on wages of post-training workers and "guaranteed extra wages after completion of training" which guarantee a minimum wage raise to post-training workers, also financed through tax over post-training workers (ibid: 196-199). However, Ritzen also points out the problem of adverse selection and moral hazard for both schemes (ibid: 198-200), since workers with higher expected future wages are less likely to participate in the training (ibid: 198).

Booth and Chatterji suggests that distortion of training investment in imperfect markets are threefold: number of workers being trained is below optimal level; level of training is below optimal level; package of general and specific skills is chosen to reduce turnover rather than solely on business needs (Booth and Chatterji 1998: 328-329). However, booth and Chatterji also points out the ineffective of government intervention in improving investment in on-the-job training (ibid: 329). They argue that government sponsored programs are usually expensive, and even more costly than market failures (ibid). As an alternative, the study suggests to switch the focus to the role of trade unions to improve the labour market performance in training provision (ibid).

Similar approach can be found in Acemoglu and Pischke's study (Acemoglu and Pischke 1999b). They admit the fact that market failures lead to underinvestment in on-the-job training and provide rationale for public intervention (ibid: F126). At the same time, they also point out that government intervention such as training subsidies may be hard to monitor and ineffective, or a "windfall gain" to the firms that receive training subsidies but still provide the same amount and/or quality of training (ibid: F127). Moreover, training programs that are provided directly by the government may not meet the needs of business and technological development (ibid). Empirical evaluation of government programs provides mixed results and shows that relatively successful programs are always costly (ibid: F128). Thus, Acemoglu and Pischke suggest some forms of regulation that help control and monitor the quantity and quality of firm-sponsored training (ibid).

Simpson conducts an empirical study to examine the impact of government assistance on private training decisions (Simpson 1984). The empirical results show that government assistance encourages investment in firm specific training in a short period but discourages general training, although the relationship is statistically insignificant (ibid: 447). This result is consistent with the conventional human capital theory predictions that firms only finance part of the specific training and none of the general training (ibid). In other words, this indicates that such government assistance to employers is ineffective in increasing general on-the-job training. Simpson suggests that subsidies to workers rather than to firms may be more effective with regard to general training (ibid).

However, not all studies agree on public intervention in firms training decisions. As opposed to market failures, some studies also point out the “nonmarket failures” in providing on-the-job training. Hansen reviews federal government training programs in United States and the rationale behind them and finds that the willingness to improve labour market performance through public intervention in the past few decades was considerable and the expenditure was large while the results were at best mixed (Hansen 1991: 215). The nonmarket failures are summarized as follows. The first one is called the “public goods – internalized failure”, which suggests that the programs tend to select individuals that are more likely to meet performance rather than individuals that can benefit from the programs (ibid: 226). The second one is “derived externalities”, which suggests that public intervention often produce negative and undesirable side effects (ibid: 224-225). “Concentration of market power” is the third nonmarket failure, which causes inefficient allocation of resources due to the lack of competition (ibid: 225). Finally, Hansen points out the problem of distribution disparity in favour of power and prestige in the operation of public training programs (ibid: 225). However, it is hard to measure which one is more costly, market failure or nonmarket failure. As Hansen states, both private market and public programs subject to some kinds of failures and the crucial question is to find a balance between the two (ibid: 229).

## **VIII. Conclusion**

This paper reviews the development of studies on on-the-job training, both theoretically and empirically. Becker’s work of human capital theory has laid down the ground for further analysis on this issue. His conclusions about general and specific training are very

influential but also controversial. Most studies of on-the-job training that followed Becker's work are to some extent his conventional human capital model.

Studies of how training decisions are made after Becker have mainly focused on three questions: who pays for the on-the-job training, especially general training; which factors have impacts on training decisions; and whether optimal amounts of training can be achieved in private sector. Factors included in the studies are minimum wages legislation and union coverage, labour and capital market imperfections, and employer and employee characteristics. These studies also extend to cover the relationship between training and productivity and wage growth. Empirical results based of these models are quite mixed and no agreements can be achieved.

Although training is mainly a private sector activity, it is widely acknowledged that the market of private training does not work as it should be and suboptimal training decisions widely exist. Thus, some studies have focused on market failures and the possibility of public intervention. There is a growing number of available public programs on training nowadays but the effects of these programs are hard to measure. Most studies of these public programs have shown that they are inefficient and costly, and usually cannot reach the designed goals. As Hansen argues, nonmarket failures in the government sponsored training programs may outweigh the cost of private market failures (Hansen 1991). It is not to suggest that the government should do nothing about on-the-job training, but it indicates that a research gap exists before designing good and sound public policy of on-the-job training.

It has been more than 40 years since the publish of Becker's *Human Capital* and research in the area of on-the-job training is now much more fruitful. However, some issues, especially public roles in training remain unclear. In the context of population aging, skill shortages, and growing international competition, on-the-job training is gaining more and more attention. Future studies are important to fill these research gaps.

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