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EFFECTS OF COHORT SIZE ON MALE EXPERIENCE-EARNINGS PROFILES IN KOREA

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EFFECTS OF COHORT SIZE ON MALE

EXPERIENCE-EARNINGS PROFILES IN KOREA

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By

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ABSTRACT

The objective of this study is to investigate the relationship between labor force age (or experience) composition and the experience-earnings profiles in Korea in order to understand the dynamics of these earnings profiles. It has been argued that the aggregate earnings profiles may be twisted over time when the age composition of the labor force changes, and workers of different ages are imperfectly substitutable in production.

During the 1970s and early 1980s, the structure of male earnings changed noticeably and the changes coincided with the arrival of the peak-sized cohorts spawned by the post-Korean War baby boom. Thus, the changes in age composition of labor force are supposed to be a major factor in the explanations given for the earnings changes.

Theories and approaches which hinge on the supply of labor have been advanced and empirically examined by Freeman (1979) and Welch (1979), and modified and broadened by scholars such as Grant and Hamermesh (1981) and Berger (1983b, 1984, 1985) in the case of the U.S. Even though previous research has established that baby-boom cohorts have suffered depressed earnings relative to older cohorts, there is a disagreement regarding the steepness of the earnings profile of these large cohorts.

In specifying human capital earnings equations for the analysis in the case of Korea, this study modified the specification employed in the previous studies. First, the earnings equations are here

estimated by firm size and educational level in order to consider the firm size differences in demand for labor. Second, the period effects on real earnings are eliminated to avoid a specification error and completely capture the parallel shifts of cross-sectional earnings profiles over time.

In this pooled time-series analysis by using the data from Occupational Wage Surveys of Korea covering the period from 1972 to 1982 by two years intervals, it is found that while cohort size depresses earnings at entry, these negative effects of cohort size diminish and wages reach "normal" levels at relatively young ages, except for college graduates in small and medium-size firms. That is, cohort size generally has a negative effect on earnings levels, but a positive effect on early career earnings growth in Korea's labor market. Moreover, the greatest positive effect on earnings growth is found in small firms for all education levels, which is consistent with the idea that the substitutability between younger and older workers is greatest in small firms, and the smallest in large firms.

The regression results for the college graduates in small and medium firms indicate a positive effect of cohort size on earnings even in the early career phase. One interpretation of this finding is that there would be relatively strong complementarity between work activities performed at different phases of the career in professional and managerial capacities where the highly educated tend to be concentrated. The other possible interpretation is that there could be a specification error in the earnings equations estimated, which do not completely control for changes in the quality of schooling in different cohorts.

In summary, cohort size effects on earnings levels generally appear to decline with experience. The effects of large swings in demographic composition of the labor force on the structure of earnings may be temporary in nature.

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CHAPTER I

INTRODUCTION

The main purpose of this study is to analyze the effects of cohort size on male experience-earnings profiles by firm size (small, medium, and large-scale firms) in Korea within the framework of human capital theory.

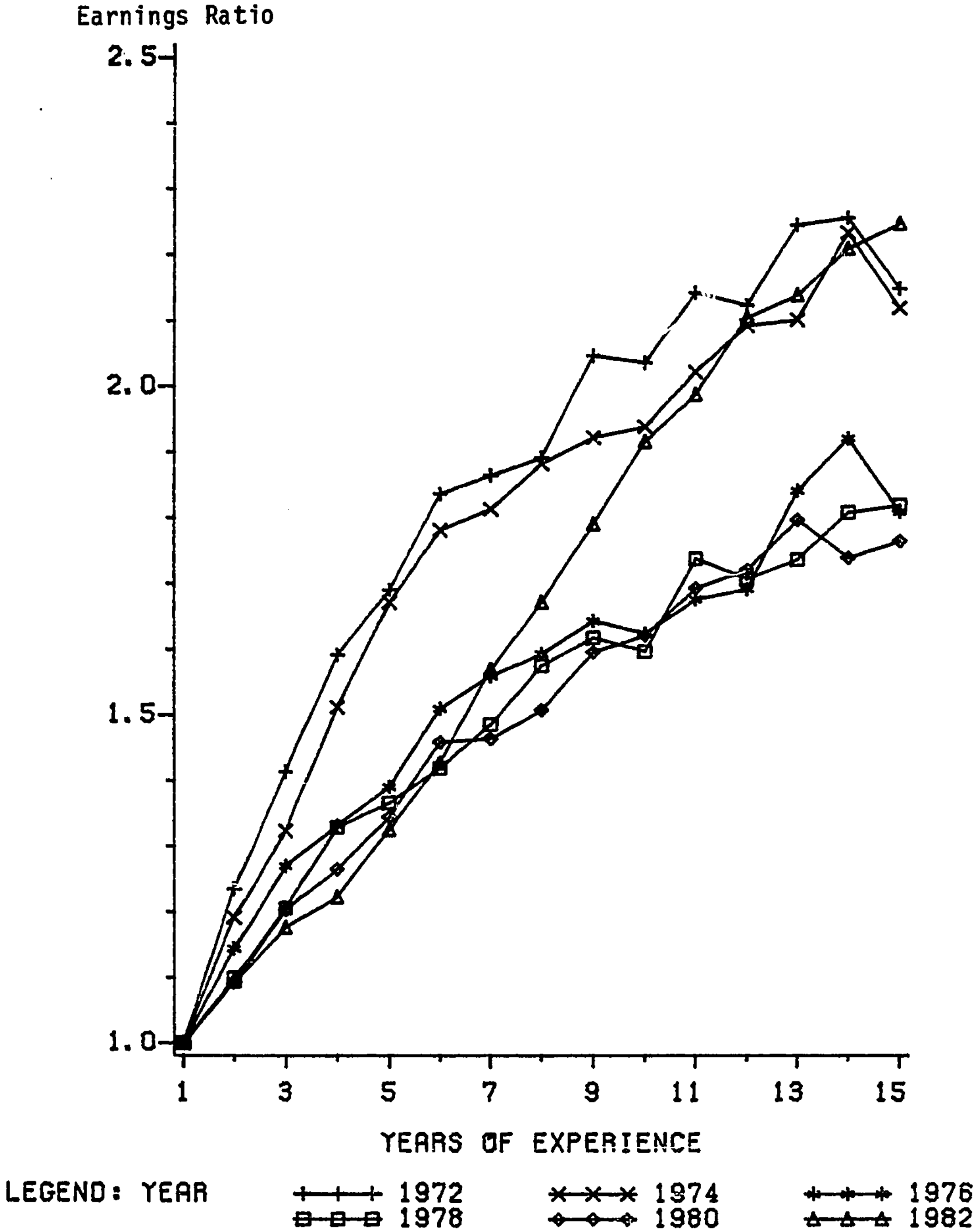
The characteristics of age-experience profiles of earnings have been analyzed extensively in many countries in order to explain the distribution of personal income with individual data and to gain a better understanding of the labor market, especially of earnings determination. There is also a third reason for this interest; the aggregate earnings profiles may be twisted over time when the age composition of the labor force changes, and workers of different ages are imperfectly substitutable in production.

During the 1970s and early 1980s, the structure of male earnings by educational groups in Korea changed noticeably, as shown in Figures 1, 2, and 3 for primary and middle school, high school, and college graduates, respectively. In these graphs, the experience-earnings profiles are represented by the ratio of average monthly earnings for each experience group to earnings of those with one year of work experience.

Much of the attention in the case of the group of primary and

FIGURE 1

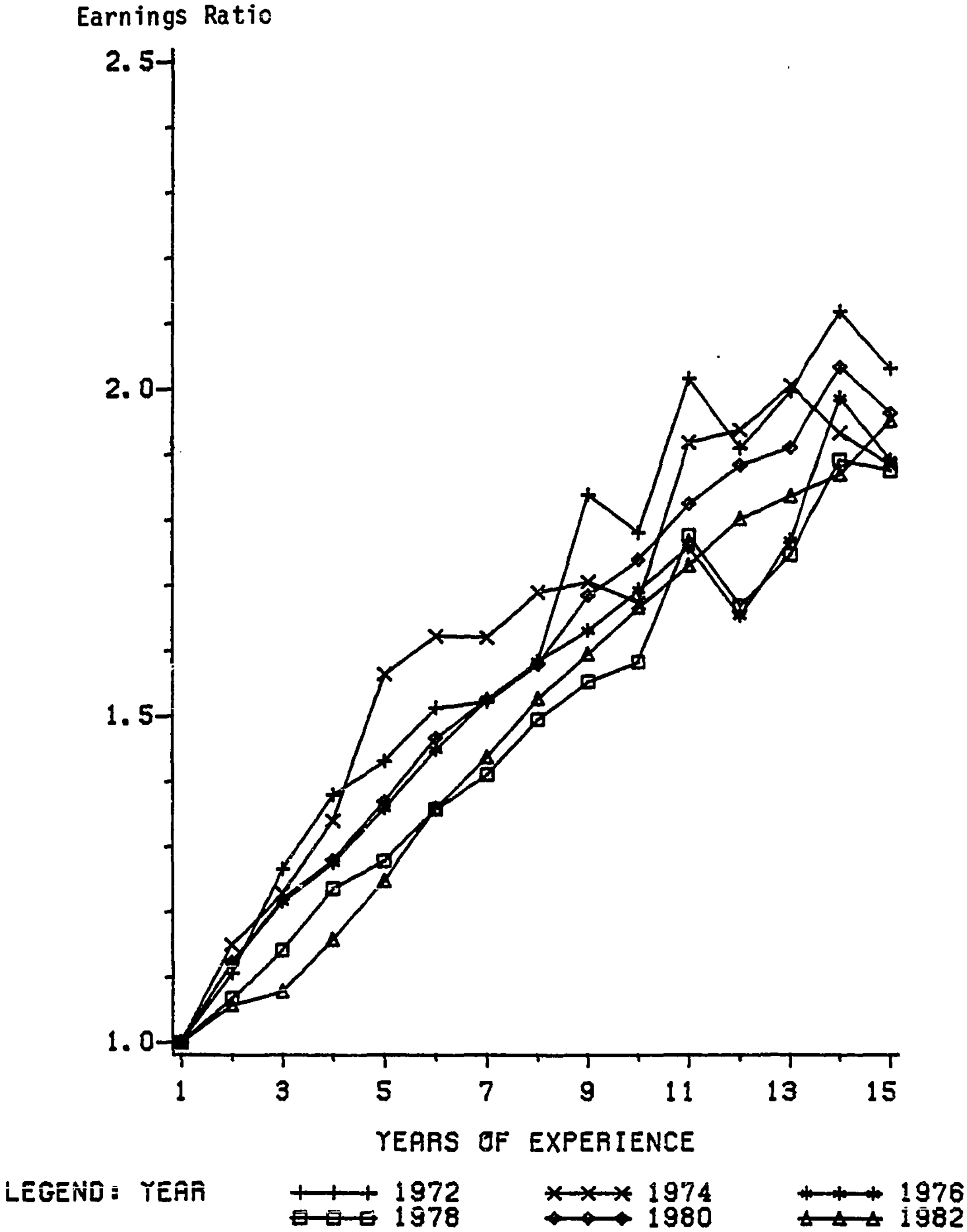
Experience-Earnings Profiles, 1972-1982
(Primary and Middle School Graduates)



Note: The values for the graph are calculated from the Occupational Wage Survey of Korea for each year.

FIGURE 2

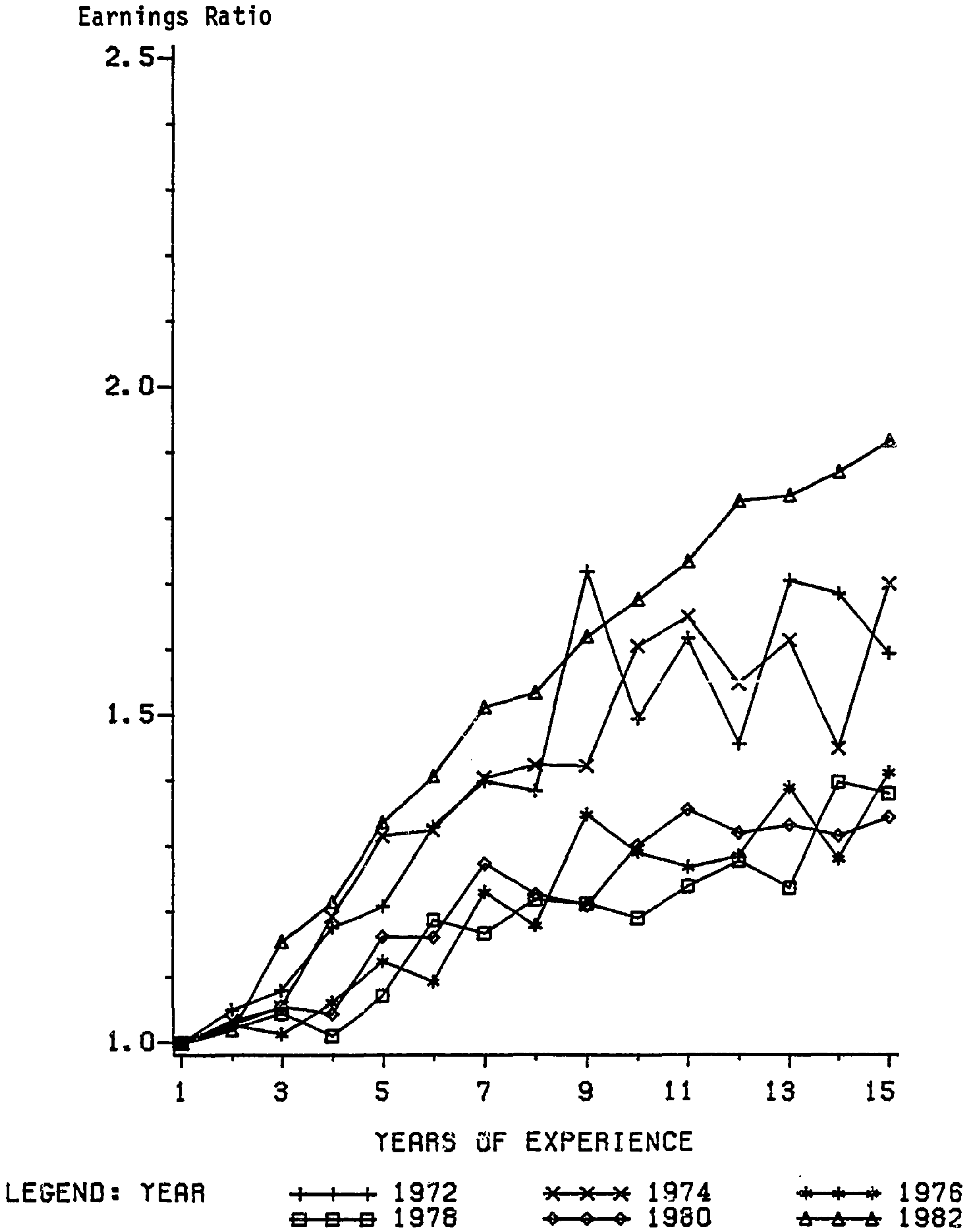
Experience-Earnings Profiles, 1972-1982
(High School Graduates)



Note: The values for the graph are calculated from the Occupational Wage Survey of Korea for each year.

FIGURE 3

Experience-Earnings Profiles, 1972-1982
(College Graduates)



Note: The values for the graph are calculated from the Occupational Wage Survey of Korea for each year.

middle school graduates is focused on the fall of the earnings profiles from 1972 to 1980 and the expansion of the earnings profile in 1982. The earnings profiles of high school and college graduates are observed to expand from 1978, remarkably expand for college graduates in 1982. That is, the relative earnings of younger to older workers were low in the early 1970s for primary and middle school graduates, not clear-cut for high school graduates, and remarkably low in the early 1980s for college graduates. These changes coincided with the arrival of the peak-sized cohorts spawned by the post-Korean War baby boom. Thus, the changes in age composition of labor force are supposed to be a major factor in the explanations given for the earnings changes.

Theories and approaches which hinge on the supply of labor have been advanced and empirically examined. The most compelling approaches are those advanced by Freeman (1979) and Welch (1979), and modified and broadened by scholars such as Grant and Hamermesh (1981) and Berger (1983b, 1984, 1985). Based on the assumption of imperfect substitutability between younger and older, more experienced workers (junior and senior), this line of analysis asserts that changes in the age (or experience) composition of labor force cause a tilt in the relationship between years of experience and earnings. That is to say, the entry of the largest postwar baby-boom birth cohorts into the labor force should increase the ratio of younger to older workers and reduce the relative earnings of junior to senior workers.

Korea experienced a baby boom in the late 1950s following the Korean War (1950-1953) and rapidly declining birth rate in the 1960s due to the expansion of family planning. There was, therefore, a significant change in the age structure of workforce in the 1970s and early 1980s, when the baby-boom cohorts entered the labor market.

Keeping it in view that the substitutability between younger and older workers is different in large and smaller firms, the analysis will be done separately for the three types of firm size (small, medium, and large firms). In Korea's labor markets, capital intensity, specificity of training, wages, etc. are different in firms of different sizes. Large firms are relatively stable in terms of recruitment, permanent contracts with labor, promotion, etc., while the smaller firms operate more like an auction market with high turnover rates. Also, rapid industrialization experienced recently by the Korean economy has intensified interscale differences in capital intensity and market power. Both of them are likely to be positively related to the specificity of training, which would affect the earnings growth in a cohort with changes in costs of and returns on human capital investment through on-the-job training.

This study consists of six chapters. Chapter II will present the survey of literature relevant to this study. This chapter will overview three general approaches related to the supply side of labor and discuss the advantages and disadvantages of each approach. Chapter III will describe the changes in demographic factors and labor force age composition, and provide some evidence for the interscale differences in the Korea's labor market. Some institutional factors for wage determination in the labor market will be discussed in the last section of the chapter. In Chapter IV, a theoretical framework, with special emphasis on the negative effect of cohort size on earnings and indeterminate effect on earnings growth of large cohorts, and its empirical model specification will be described. Chapter V will describe the data and sample for this study and present the empirical results on the earnings equations, comparing the results by firm size with a given level of education. The final chapter includes the summary of findings, limitations of the study, and suggestions for further research.

CHAPTER II

REVIEW OF THE LITERATURE

A. The Effect of Cohort Size on Earnings

1. CES Production Function Approach

The constant elasticity of substitution (CES) production function has only one elasticity of substitution, which is defined as $S_{ij} = \partial \ln(X_i/X_j)/ \partial \ln(W_j/W_i)$. It is reasonably simple to estimate, considering only two factor inputs (i and j) and provides direct information on the impact of relative quantities on relative earnings, by using the following relative wage determination equations:

$$(2.1) \quad \ln (W_i/W_j) = -(1/S_{ij}) * \ln (X_i/X_j) + Z + \text{error},$$

where S_{ij} = elasticity of substitution,

(W_i/W_j) = wage ratio between age group i and j,

(X_i/X_j) = relative number of workers between i and j,

Z = vector of other variables, for example, an indicator of cycle.

The possibility of changes in relative wages being due largely to cyclical rather than demographic changes can be readily examined with the above equation by addition of variables measuring the business cycle. But it can not be used to test the possibility that in a consistent production function framework changes in other factors, such as, capital, may be influencing the relative demand for labor of different ages.

Freeman (1979) used this approach for the U.S., and Martin (1982) and Mosk and Nakata (1985) for Japan. Freeman (1979) finds that the estimated effects of demographic, cyclical, and time trend factors using relative wage equations suggest that the observed twist in age-earnings profiles against young men can be attributed in large part to the changed age structure of the work force. Also, he finds that the increased number of young male workers relative to the number of old male workers have an especially large impact on college graduates' profiles compared to only a modest impact on high school graduates' profiles.

Martin (1982) finds that cohort size significantly affects the relative wages of age groups and that wages are also affected by general economic conditions in the case of Japan. Mosk and Nakata (1985) emphasize the dualistic structure of the Japanese labor market segmented into two sectors - a primary market of large firms and a secondary market comprised principally of small firms, by estimating the relative wage equations separately for each firms. They also emphasize the importance of structural shift on the demand side, especially that associated with the slowing down of output growth as Japan caught up with Western economies, by estimating the equations for each period before and after the Oil Crisis of 1973. In their analysis, it is found that demographic changes, specifically the aging of the labor force in Japan, had a profound impact on the relative wages of senior to junior workers.

2. Translog (TL) Production Function Approach

The Transcendental Logarithmic (TL) system provides estimates of elasticities of complementarity (C_{ij}) for more than two inputs in a consistent production function framework which assumes exogenous factor quantities. It is better suited for the analysis of relative earnings changes than the TL cost function, which assumes exogenous factor prices. For older workers, factor quantities are more properly viewed as exogenous than are factor prices. This approach has two disadvantages: First, specification and measurement errors in the equation for a factor of only marginal concern, such as for capital in the case at hand, can greatly affect estimates of the demand equations for other factors. Second, the TL model is an equilibrium model that can not be readily modified to allow for the effect of cyclical factors on relative demands.

The formal specification of the TL production function is

$$(2.2)\quad \ln Q = \ln a_0 + \Sigma_i a_i \ln X_i + 1/2\,\Sigma_i \Sigma_j r_{ij} \ln X_i \ln X_j,$$

where the X_i are the inputs and Q is output.

The standard first-order conditions for profit maximization, with the assumption that markets are competitive, are

(2.3) $\partial Q/\partial X_i = P_i$,

where P_i is the price of the i^{th} factor and the price of output is unity. These can be stated in logarithmic form as

(2.4) $\partial \ln Q/\partial \ln X_i = P_i X_i/Q = S_i = a_i + \Sigma_j r_{ij} \ln X_j$,

where S_i is the share of output accruing to the i^{th} factor.

After imposing the assumption of homogeneity ($\Sigma_i a_i=1$, $\Sigma_i r_{ij}=0$, $\Sigma_j r_{ij}=0$, $\Sigma_i \Sigma_j r_{ij}=0$) and symmetry ($r_{ij}=r_{ji}$), the system of share equations can be rewritten after dropping the k^{th} equation:

(2.5) $S_i = a_i + \Sigma_{j\neq k} r_{ij}(\ln X_j - \ln X_k)$.

This system of equations is estimated using a restricted version of the Zellner's (1962) seemingly unrelated regression method.

The estimated parameters from (2.5) can be readily transformed to obtain estimates of the inverse of the Hicks' (1970) partial elasticities of complementarity (C_{ij}):

(2.6) $C_{ij} = r_{ij}/S_i S_j + 1$, $C_{ii} = (1/S_i^2)(r_{ii} + S_i^2 - S_i)$.

Any pairs of factors are: q-complements if $C_{ij} > 0$

q-substitutes if $C_{ij} < 0$

and the estimated own elasticities of complementarity (C_{ii}) are negative for well-behaved production function.

Sato and Koizumi (1973) show that the factor price elasticity, or the percent change in price of factor i given a change in the quantity of factor j or i used in production is:

$$(2.7) \quad e_{ij} = \partial \ln P_i / \partial \ln X_j = S_j C_{ij},$$
$$e_{ii} = \partial \ln P_i / \partial \ln X_i = S_i C_{ii}.$$

Given equation (2.7), the following expression for percentage changes in relative factor prices can be derived, assuming all factor quantities are allowed to vary:

$$(2.8) \quad \partial \ln P_i - \partial \ln P_k = \Sigma_{i \neq j \neq k} S_j (C_{ij} - C_{jk}) \partial \ln X_j + S_i (C_{ii} - C_{ik}) \partial \ln X_i + S_k (C_{ik} - C_{kk}) \partial \ln X_k.$$

This expression can then be used to predict changes in relative earnings and to divide each change into amounts due to differences in the employment of each factor.

Freeman (1979), Grant and Hamermesh (1981), and Berger (1983b) employ the TL system in their analyses of relative earnings in the U.S.

Freeman (1979) estimates a TL production function with the number of male workers aged 20-34, the number of male workers aged 35-64, the number of female workers aged 20-64, and the quantity of capital as inputs (see Table 1). He finds that the earnings of men aged 20-34 depend critically on the number of young male workers. The

TABLE 1

Input Factors in Translog Production Function

Author(s)	Input Factors Employed	Data Description
Freeman (1979)	Men 20-34, Men 35-64 Women 20-64, Capital	Entire Economy CPS* 1950-1974
Grant and Hamermesh (1981)	Youths 14-24 (Y) Adult Blacks (OB) White Women (OFW) White Men (OMW) Capital (K)	Manufacturing SMSAs, Census of Population,1970
Berger (1983b)	Males, 0-15 years of schooling and 0-14 years of experience (YHS) Males, 16+ years of schooling and 0-14 years of experience (YC) Males, 0-15 years of schooling and 15+ years of experience (OHS) Males, 16+ years of schooling and 15+ years of experience (OC) Females (F) Capital (K)	Entire Economy CPS 1968-1975

Note: *March Current Population Surveys

own elasticity of complementarity for the number of young men (C_{ii}) is sizably negative and far in excess of the cross-elasticity between young and older men (C_{ij}). This implies that an increase in the number of young men would reduce their wage relative to the wage of older men. Most importantly, the estimated factor price elasticities indicate that changes in the numbers of male workers of different ages will substantively influence the earnings of younger and older men and are therefore likely to alter male age-earnings profiles.

Grant and Hamermesh (1981) disaggregate factor inputs into five categories: youths aged 14-24, adult blacks, white women, white men, and capital. They find that youth and adult women are close substitutes in production, so that an influx of the latter shifts the demand curve for youth sharply to the left, and cause some displacement in the earnings of youth. Part of the sharp relative decline in earnings of young workers that occurred in the late 1960s and 1970s is thus attributable to the increase in the adult female labor force. The baby boom of the 1950s is not the only reason for the relative decline in earnings of the youth labor force.

Berger (1983b) suggested the estimation of TL models of aggregate production with labor inputs segmented by labor market experience, schooling, and sex (see Table 1). This, in his view, would also be of help in consideration of the substitution between schooling groups in a production. This segmentation is suggested to consider the previous results that the increased relative supply of college graduates is one of the reasons for the decline in their earnings relative to high school graduates (Freeman, 1975) and that male workers of different ages are imperfectly substitutable in production, possibly due to different activities performed at various stages of the career (Freeman, 1979; Welch, 1979). Berger's results indicate that, among males, those in the same experience category but with different amounts of schooling (YHS and YC) are q-substitutes. On the other hand, among college graduates, younger and more experienced workers (YC and OC) are q-complements. But for those with less than a college degree, younger and older workers (YHS and OHS) appear to be q-substitutes. Members in different schooling and experience categories (YHS and OC, YC and OHS) are also q-substitutes, and females and the male labor force, especially younger, less educated males (F and YHS), are q-substitutes. Thus, the rapid increase in the number of young male college graduates appears to have been the largest contributer to the decline in their earnings relative to less educated young males and older male college graduates. The increase in female participation appears to have contributed significantly to the decline in the earnings of younger workers relative to older workers among those with less than a college degree. In addition, he finds that the negative earnings effects of cohort size persist over the life cycle, but that the observed decline in the earnings of young college graduates relative to other young workers during the 1970s does not signal a permanent decline in value of college, based on the prediction of future relative earnings change.

3. Human Capital Approach

The dominant theory for explaining age-earnings profiles is the human capital approach of Becker (1962, 1964), Mincer (1958, 1962, 1970, 1974) and Schultz (1962, 1964). Investments in schooling, on-the-job training and other forms of human-capital accumulation increase the earnings capacity of individuals. Their distribution over the life cycle determines the particular shape of the age-earnings profile.

The human capital theory predicts that earnings will increase with schooling and in general with age (or experience), but that earnings rise with age at a declining rate. The logarithm of earnings are therefore estimated as a function of education, experience, experience squared, cohort size, and other control factors.[1] During the seventies, researchers began to notice sizable changes in the structure of male earnings, and they found that the composition of the labor force was a major factor in the explanation of the changes. Thus, it is argued that cohort size, indicating the composition of the labor force, is as important as the others in the earnings functions in order to understand the dynamics of the experience-earnings profiles over time.

Johnson (1980) estimates an earnings function to investigate the vintage (or cohort) effects on the earnings of white American men including a variable, RELSIZE, defined as the number of 16-19 year olds relative to the civilian labor force in the year of entry. Vintage effects, here, are defined as the differences in earnings between cohorts that can not be explained by either secular growth or the normal age-experience profile of earnings. Using the panel data taken from the University of Michigan's Panel Study of Income Dynamics, he finds the cohort size effect is significantly negative only for college graduates.

Rosen and Taubman (1982) estimate Tobit earnings functions with dummy variables for each birth cohort and they find that cohorts born after World War II show earnings no larger than those born in the 1930s, by using a matched sample of Social Security and March Current

Population Survey (CPS). However, when demographic factors, namely, veteran status, are controlled, earnings show no tendency to vary with cohort size.

In order to investigate cohort size effects on the earnings profile, Welch (1979) estimates annual and weekly log earnings equations for white males with March Current Population Survey (CPS) data covering the period from 1967 to 1975. The sample is segmented into four schooling completion groups: 8-11 years, 12 years, 13-15 years, and 16+ years. Within each schooling group, the data are cross-classified into 44 experience and 9 year groups yielding 396 total cells. The estimation takes place using this aggregated data with each observation weighted by the square root of the frequency of each group to avoid heteroscedasticity problems inherent in grouped data.

In each earnings equation, the amount of previous labor market activity is controlled for by "full density" measures of experience, experience squared, and an early career spline variable (S). The spline variable takes on the value one at entry and then declines linearly to zero in six to nine years. Cohort size is measured within each schooling group as a moving average of individuals in adjacent experience groups relative to the total number of indivduals with that level of schooling.[2] Variation in the cohort size effect on earnings over the life cycle is obtained by interacting cohort size with the early career spline variable, which is $S=(1-X/a)*D$,

where X = experience,

a = 6,7,8,and 9 years, respectively, for those with 8-11, 12, 13-15, and 16+ years of schooling,

$D = 1$ if $X \leq a$

0 otherwise.

The actual earnings equation specification estimated by Welch is

$$(2.9)\ \ln W = b_0 + b_1X + b_2X^2 + b_3S + b_4\ln C(X) + b_5S*\ln C(X) + Z + e,$$
$$= b_0 + b_1X + b_2X^2 + b_3D - (b_3/a)X*D + b_4\ln C(X)$$
$$+ b_5\ln C(X)*D - (b_5/a)X*\ln C(X)*D + Z + e,$$

where W = real earnings,

$C(X)$ = cohort size,

Z = a vector of control variables; unemployment rate, time trend, exclusion rate due to nonwork, and exclusion rate due to income imputation,

e = error term.

Welch (1979) finds strong evidence that large cohorts do depress earnings and that most of the effect comes early in the career. The evidence also suggests that cohort size effects increase with level of schooling.

Lin (1982) used this human capital approach developed by Welch (1979), and included the development characteristics (Z), such as industrialization, urbanization, and occupational composition. Earnings equations are there estimated using the 1976 cross-section raw data and seven years time-series data from 1964 to 1976 by two years intervals, collected from a published paper. His specification of the earnings function for Taiwan is as follows:

$$
\begin{aligned}
(2.10)\ \ln W &= b_0 + b_1X + b_2X^2 + b_3\ln C(X) + b_4S*\ln C(X) + Z + e \\
&= b_0 + b_1X + b_2X^2 + b_3\ln C(X) + b_4\ln C(X)*D, \\
&- (b_4/a)X*\ln C(X)*D + Z + e,
\end{aligned}
$$

where Z is a vector of development characteristics expressed with dummy variables for industries, job location, and occupations.

Lin, contrary to Welch's model, dropped the early career spline (S) as one of explanatory variables of earnings equations. It means that the intercept (b_0) and the parameter estimate of X (b_1) are restricted to be equal over the life cycle.[3] His results are different from findings of previous studies done in the United States. First, the negative cohort size effects on male earnings in Taiwan only prevail for those workers who have not received any college education and still are in the early stage of their careers. Second, the effects of cohort size for those male workers with a college education are not significant at the early stage of their careers. Also, significant and positive cohort size effects are observed for the earnings of those who have passed this very early stage in the male college group. Thus, he concludes that the age-earnings profiles in Taiwan are much more affected by the economic structure than by the labor force age composition.

The studies cited above indicate that the cohort size and earnings literature has focused principally on average cohort earnings. Dooley and Gottschalk (1985) study demographic structure in relation to the proportion of low earners in male labor force (an annual and a weekly low earnings threshold are fixed in real terms at

$6,280 per year and $120 per week, respectively, in 1975 prices) and assess the extent to which any such relationship is transitory. They used logit function with the same explanatory variables as Welch's to estimate the impact of cohort size on the probability of low earnings conditional on education and experience using the data from March CPS 1968-1979. They find little support for the assertion that the recent rise in the incidence of low earnings was principally a transitory demographic phenomenon not only for the members of the baby-boom cohorts, but also for the male labor force as a whole, because the time trend coefficients in their model are not trivial. This implies that the major portion of the increase in the aggregate proportion of low earners can not be explained on the basis of an increase in the ratio of younger to older workers. They alternatively suggest to investigate changes in female labor supply or the structure of labor demand for the analysis of the cohort size effect on earnings profiles.

B. The Effect of Cohort Size on Earnings Growth

Even though previous research has established that baby-boom cohorts have suffered depressed earnings relative to older cohorts, there is a disagreement regarding the steepness of earnings profile of these large cohorts. Welch (1979) asserts that the wage-depressing impact of large cohort size is felt most strongly in the early years of the work life and diminishes with experience. Hence, the recent large cohorts of labor force entrants should exhibit earnings profiles with lower intercepts and steeper slopes than those of smaller cohorts. On the other hand, Freeman (1981) reports that throughout the 1970s, the earnings of young college graduates grew less rapidly with age than the earnings of young high school graduates, coinciding with the increases in the size of entry cohorts.

Dooley and Gottschalk (1984) argue that the costs of human capital investments are reduced in larger cohorts because of depressed earnings level. Besides, the expected returns to investments by the baby-boom cohorts are larger than those by other age groups, since slower future labor force growth, due to the post-World War II baby boom and baby bust, will make human capital more valuable. Thus, their model which assumes homogeneous human capital predicts the same as Welch's argument; however, the underlying reasons are temporarily depressed rental rates and increased postschooling investment.

Berger (1984), on the other hand, argues that the cost per worker of a given level of investment activity is higher in larger cohorts, because of the increases in time value spent by other workers providing training for the large cohorts. He also argues that the return to human capital investments are likely to decrease with cohort size, because of worker's different mixes of human capital becoming less valuable to employers. His argument is confirmed by estimating earnings-growth equations using samples drawn from the 1968-1975 March Current Population Survey (CPS) and the National Longitudinal Survey of Young Men (NLS). Also, Berger (1985) criticizes Welch's argument, based on different results from the estimation of earnings equations relaxed some restrictions of Welch's model specification. He finds that cohort size generally has a negative effect on earnings levels, but also appears to slow down earnings growth.

FOOTNOTES

1. Mincer (1974) derived the earnings equation which has the variables such as education, experience, and experience squared, based on the human capital theory. Log of weeks worked (ln WKS) was added in his earnings equation to control for an upward bias in the rate of return to education, because more educated men work more weeks per year.

2. If N_{ij} is the number of individuals in schooling group j with i years of experience, Welch's cohort size measure can be expressed as

$$C(X) = \frac{(1/9N_{i-2,j} + 2/9N_{i-1,j} + 3/9N_{i,j} + 2/9N_{i+1,j} + 1/9N_{i+2,j})}{\Sigma_i N_{ij}}$$

   The weights are scaled up to sum to one when experience equals one or two.

3. In the case of the Welch's model specified in the equation (2.9), we can see the changes in the intercept and parameter estimate of X over the life cycle, by comparing b_0 and b_3D, and b_1X and $-(b_3/a)X^*D$, respectively.

CHAPTER III

THE SURVEY OF KOREA'S LABOR MARKET

A. Demographic Changes and Labor Force Age Composition

1. Population

To look at the changing trend of labor force age composition during the 1970s, the demographic situation will be examined in this section, because the labor force age composition is determined by both the size of various age groups in the population and their labor force participation rates.

According to the 1980 Population and Housing Census Report, the population in Korea is 37,407 thousand persons, an increase of 74 % over the 25 year period since 1955. As Table 2 shows, the population growth rate increased from 1.0 % in 1955 to 2.8 % in 1960 and then decreased to 2.3 % in 1970 and to 1.6 % in 1980. This is mainly due to the increase in crude birth rate (CBR) from 40.0 to 43.0 per 1,000 persons and reduction in crude death rate (CDR) from 33.0 to 14.6 per 1,000 persons during the period 1955-60, and due to the reduction in CDR from 43.0 to 23.4 per 1,000 persons, which outbalanced a slow but steady decreasing trend in CDR during the period 1960-80.

As shown in Table 3 and Figure 4, the age-specific fertility

TABLE 2

Total Population and Vital Statistics

(Unit: per thousand)

Year	Population (1,000)	CBR	CDR	RNI	PGR
1955	21,502	40.0	33.0	7.0	10.1
1960	24,989	43.0	14.6	28.4	28.4
1966	29,160	37.0	10.5	26.5	26.5
1970	31,435	32.1	9.4	22.7	22.7
1975	34,679	27.6	8.6	19.0	18.0
1980	37,407	23.4	6.7	16.7	15.7

Source: Bureau of Statistics, Economic Planning Board.

Note: CBR=Crude Birth Rate, CDR=Crude Death Rate, RNI=Rate of Natural Increase, PGR=Population Growth Rate.

rate (ASFR), which is the number of births occurring annually per 1,000 women of specific age, for ages 15-19 declined consistently and very considerably during the whole period. This was undoubtedly the result of a drastic rise in proportion of single women in this age group.[1] The fertility rates of other age groups increased during the period 1955-60 without exception, as would be expected given the baby boom after the Korean War (1950-1953). Since 1960, the age-specific fertility rates for age 25 and over show a tendency to decline. The level of fertility for ages 25-29, however, still

TABLE 3

Age-Specific and Total Fertility Rates

(Unit: per thousand)

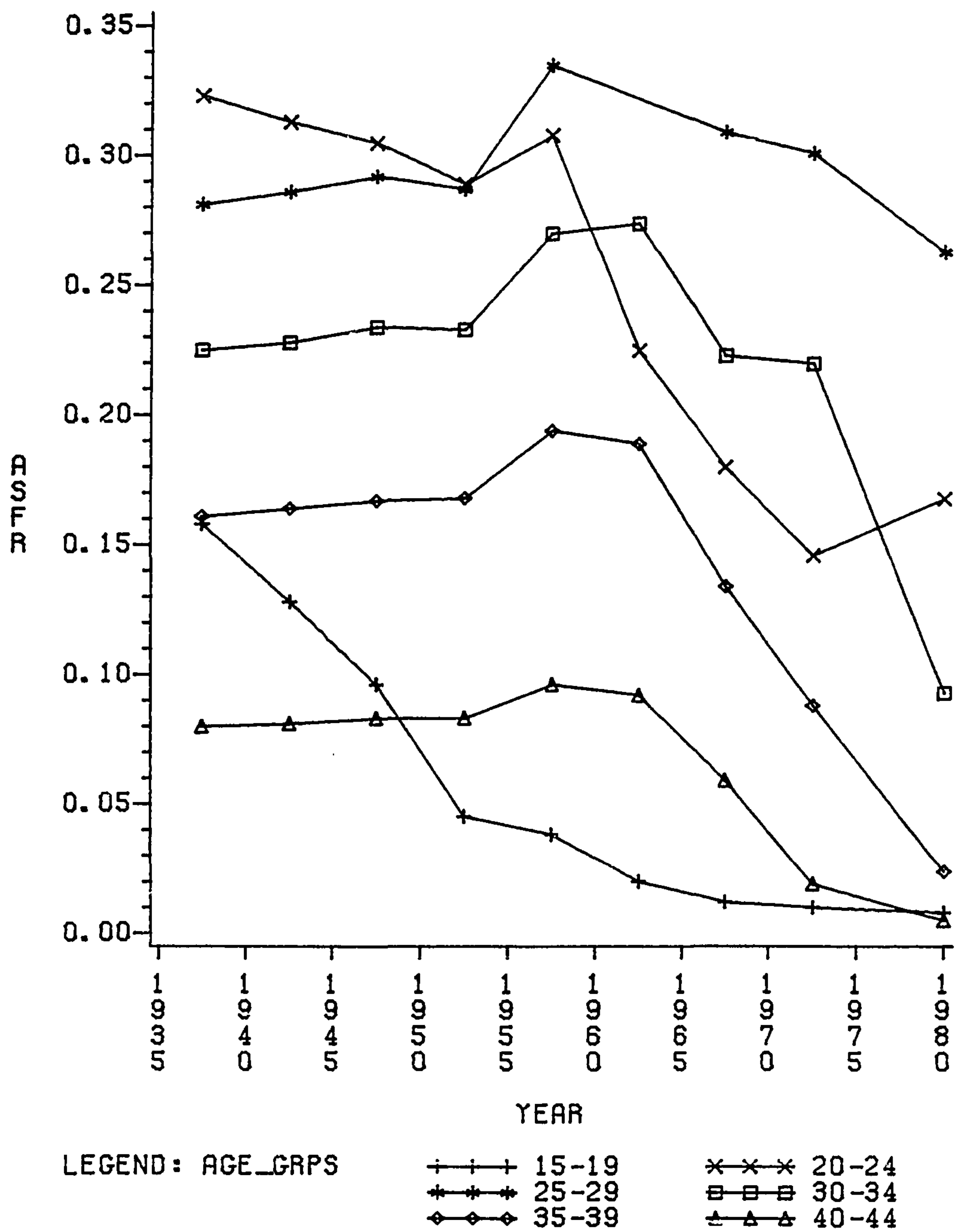
Year	1945 -50	1950 -55	1955 -60	1960 -65	1965 -70	1970 -75	1980
ASFR							
15-19	96	45	38	20	12	10	8
20-24	305	289	308	225	180	146	168
25-29	292	287	335	351	309	301	263
30-34	234	233	270	274	223	220	93
35-39	167	168	194	189	134	88	24
40-44	83	83	96	92	59	19	5
45-49	15	15	18	17	10	7	0
TFR	6.0	5.6	6.3	6.0	4.6	4.2	2.8

Source: For 1945-70, Tai Hwan Kwon et al.(1975, p. 12, p. 16)
For 1970-75, Robert Repetto et al.(1981, p. 25)
For 1980, Bureau of Statistics, *1980 Continuous Demographic Survey*.

remained high during the period 1970-75 compared to that before the baby boom period. The fertility rates for ages 30-34 and ages 35-39 during the period 1965-70 returned to the level before 1955. The total fertility rate (TFR) is defined as an estimate of the average number of children born to each women, assuming the current age-specific fertility rates remain constant. The TFR was as high as 6.3, i.e., 6 children per woman, in the period 1955-60 and declined slightly to 6.0 in the period 1960-65. Since then, the TFR has rapidly declined mainly due to the expansion of family planning program introduced in 1962 by the government. In short, the

FIGURE 4

Age-Specific Fertility Rates, 1935-1980



Source: Same as Table 3.

post-Korean War baby boom lasted almost ten years from 1955 to 1965 (Repetto et al., 1981, pp. 21-24). It is different from the post-World War II baby boom in the U.S. which continued for over fifteen years and in Japan which experienced it only for about three years (Martin, 1982, p. 20). The baby boom in Korea is more conspicuous during the period 1955-60 than the period 1960-65.

The baby boom and subsequent fertility declines brought about a marked change in the age structure of the Korean population in later years. The population of Korea shows a balanced distribution between males and females in all age groups except the group above age 60. In this group, the female population assumes a larger proportion of total population mainly due to the longer life expectancy of females than that of males.

The age composition of the population for selected years is presented in Table 4. The figures in the table indicate the dynamic impact of the high post-Korean War fertility rate on the age composition of the population. The population of ages 0-4 in 1960, which is the baby-boom cohort, was 17.8 % of the entire population. This cohort was also the highest proportion during the 1960s and the 1970s. The gradual decline of the population at ages 0-4 through the whole period is a direct consequence of the fertility decline from the early 1960s. The baby-boom cohort is in the age group 5-9 in 1966, age group 10-14 in 1970, age group 15-19 in 1975, and age group 20-24 in 1980. It is observed that all of these groups recorded the highest proportion in the same age category during the whole period. Thus, the baby-boom cohort started to be counted in the economically active

TABLE 4

Age Composition of Population

(Unit: %)

Age	1960	1966	1970	1975	1980
Total	100.0	100.0	100.0	100.0	100.0
0-4	17.8	15.4	13.7	12.2	10.1
5-9	13.8	15.8	14.4	12.8	11.8
10-14	11.3	12.3	14.0	13.1	11.9
15-19	9.5	9.3	9.8	12.0	11.3
20-24	8.7	7.9	8.0	9.0	10.8
20-29	16.1	15.6	15.0	16.2	19.0
30-39	11.6	12.0	12.9	12.7	12.6
40-49	8.6	8.4	8.8	9.2	10.5
50-59	5.9	5.9	6.0	6.2	6.5
60+	5.4	5.2	5.5	5.6	6.1

Source: Bureau of Statistics, Population and Housing Census Report, 1960, 1966, 1970, 1975, and 1980.

population after 1970, when they reached age 14. Since then, the age composition of the economically active population, especially of the younger population, has changed. The group aged 20-29 declined as a proportion of the total population by 1.1 percentage point during the 1960s, but dramatically increased from 15.0 % in 1970 to 16.2 % in 1975 and to 19.0 % in 1980. On the other hand, the proportions were relatively stable in the old-age groups because the baby boom during the period 1955-60 and the rapid decline of fertility during the 1960s did not affect these age groups.

2. Economically Active Population

The economically active population is defined as those aged 14 and over, able and intending to engage in productive work, exclusive of soldiers, combat policemen, prisoners, those engaging in work in the home, students, decrepit people, and the handicapped. They are classified into two groups: the employed and the unemployed.

According to Table 5, the rate of growth per annum of the male labor force increased considerably from 2.38 % in the second half of the 1960s to 3.89 % in the first half of the 1970s and then decreased to 2.73 % in the second half of the 1970s, even though the male labor force participation rate declined continuously from 76.6 % in 1965 to 73.6 % in 1980. This is mainly due to the increase in the economically active population during the period 1970-75, when the baby-boom cohort entered the labor force. The rate of growth per annum of the female labor force increased steadily and slightly throughout the whole period (3.84-4.05 %) in accordance with the continuous increase in female labor force participation rate from 36.5 % in 1965 to 41.6 % in 1980, and the increase in the population of 14 year olds and over.

In the early 1960s, when the government prepared the first five-year economic development plan, the Korean economy suffered from chronic labor surplus characterized by high unemployment and underemployment. The unemployment rates were 8.4 % for males and 5.5% for females in 1965. Since then, the unemployment rate declined until the middle of the 1970s, and then increased slightly because of the

TABLE 5

Changes of Economically Active Population

(Unit: thousand persons, %)

	1965	1970	1975	1980	Average Rate of Increase per Year 1965-70	1970-75	1975-80
1. Population 14 Years Old and Over							
Total	15,937	18,253	21,833	25,335	2.75	3.65	3.02
Male	7,586	8,675	10,576	12,256	2.72	4.04	2.99
Female	8,351	9,578	11,257	13,080	2.78	3.28	3.05
2. Economically Active Population							
Total (LFPR)	8,859 (55.6)	10,199 (55.9)	12,340 (56.5)	14,454 (57.1)	2.86	3.89	3.21
Male (LFPR)	5,808 (76.6)	6,516 (75.1)	7,884 (74.5)	9,020 (73.6)	2.38	3.89	2.73
Female (LFPR)	3,051 (36.5)	3,683 (38.5)	4,456 (39.6)	5,435 (41.6)	3.84	3.88	4.05
3. Employed Persons							
Total (UNEMP)	8,206 (7.4)	9,745 (4.5)	11,830 (4.1)	13,706 (5.2)	3.50	3.95	2.99
Male (UNEMP)	5,322 (8.4)	6,167 (5.4)	7,489 (5.0)	8,462 (6.2)	2.99	3.96	2.47
Female (UNEMP)	2,884 (5.5)	3,578 (2.9)	4,341 (2.6)	5,243 (3.5)	4.41	3.94	3.85

Source: Bureau of Statistics, _Annual Report on the Economically Active Population Survey_, 1976, 1980.

Note: LFPR refers to labor force participation rate, and UNEMP to unemployment rate.

TABLE 6

Changes in Age Composition of Economically Active Population

(Unit: thousand persons, %)

	1965	1970	1975	1980
Total	8,859 (100.0)	10,199 (100.0)	12,340 (100.0)	14,454 (100.0)
14	105 (1.2)	137 (1.3)	147 (1.2)	43 (0.3)
15-19	1,225 (13.8)	1,412 (13.8)	1,528 (12.4)	1,193 (8.3)
20-24	1,064 (12.0)	1,071 (10.5)	1,425 (11.5)	1,971 (13.6)
25-29	1,228 (13.9)	1,149 (11.3)	1,499 (12.1)	1,846 (12.8)
30-34	1,151 (13.0)	1,411 (13.8)	1,510 (12.2)	1,810 (12.5)
35-39	981 (11.1)	1,300 (12.7)	1,623 (13.2)	1,787 (12.4)
40-44	960 (10.8)	1,121 (11.0)	1,386 (11.2)	1,755 (12.1)
45-49	782 (8.8)	992 (9.7)	1,057 (8.6)	1,524 (10.5)
50-54	599 (6.8)	668 (6.5)	899 (7.3)	1,032 (7.1)
55-59	434 (4.9)	497 (4.9)	663 (5.4)	776 (5.4)
60+	330 (3.7)	441 (4.3)	603 (4.9)	719 (5.0)

Source: Same as Table 5.
Note: Percentages may not add to 100 because of rounding.

TABLE 7

School Enrollment Ratio

(Unit: %)

	1966	1970	1975	1980
Primary School	96.6	102.4	103.2	101.0
Middle School	42.3	56.1	75.2	94.6
High School	27.5	30.5	43.6	68.5

Source: Bureau of Statistics, Population and Housing Census, various issues.

Note:

$$\text{The Ratio} = \frac{\text{Students at Each Level of School}}{\text{School Age Population}}$$

economic recession in 1980.

As shown in Table 6, there has been a structural change in age composition of the economically active population, especially in that of the younger age group since 1965. Because of both demographic change and increased school attendance (see Table 7), the younger age groups (14, 15-19) shrank enormously in terms of its share over the period 1965-80. On the other hand, the proportions of ages 20-24 and ages 25-29, which are younger potential labor force, increased continuously from 10.5 % in 1970 to 13.6 % in 1980 and 11.3 % in 1970 to 12.8 % in 1980, respectively. The main corps of the population over ages 30 recorded steady growth in numbers. It is noticed that the age group 20-24, which is the baby-boom cohort born over the period 1955-1960 in 1980, recorded high growth in numbers at a rate of 6.3 % annually from 1,071 thousands in 1970 to 1,971 thousands in 1980.

The distribution of employed population among primary, secondary, and tertiary industries is 58.6 %, 10.4 %, and 31.0 %, respectively, in 1965, as shown in Table 8. In 1983, its distribution among the three industries is of an entirely different complexion; primary industry accounts for 29.7 %, secondary industry for 23.3 %, and tertiary industry for 47.0 %. This change is indicative of the current trends that the labor force of rural areas is absorbed into manufacturing and tertiary industries, and that this rapid decrease in unemployment rate from 7.4 % in 1965 to 4.1 % in 1983 is mainly due to rapid increase in employment in manufacturing industries.

While the changing composition of industrial employment is a reflection of the rapid industrialization especially in manufacturing sector, the changing age composition of employment in the non-agricultural sectors reflects the results of changes in age composition of the economically active population, as well as changes in that of migrants from agricultural sector to non-agricultural sectors. Table 9 presents the changing age composition of the employed in non-agricultural sectors, which will be used in this study.

The first impression from Table 9 is the dramatic increase in the workers of ages 20-24 and ages 25-29, which rose from 371 thousand persons (10.9 % of total employed) in 1965 to 1,391 thousand persons (15.4 % of total employed) in 1980, at an annual growth rate of 9.2 %, and 454 thousand persons (13.4 % of total employed) in 1965 to 1,396 thousand persons (15.4 % of total employed) in 1980, at annual growth

TABLE 8

Percentage of Employment by Industries*
and Unemployment Rates

(Unit: %)

Year	Total	Primary Industry	Secondary Industry	/ Manufac./	Tertiary Industry	Unemp. Rate
1965	100.0	58.6	10.4	(9.4)	31.0	7.4
1966	100.0	57.9	10.8	(9.9)	31.3	7.1
1967	100.0	55.2	12.8	(11.7)	32.0	6.2
1968	100.0	52.4	14.0	(12.8)	33.6	5.1
1969	100.0	51.3	14.3	(13.1)	34.4	4.8
1970	100.0	50.4	14.4	(13.2)	35.2	4.5
1971	100.0	48.4	14.2	(13.3)	37.4	4.5
1972	100.0	50.6	14.2	(13.7)	35.2	4.5
1973	100.0	50.0	16.3	(15.9)	33.7	4.0
1974	100.0	48.2	17.8	(17.4)	34.0	4.1
1975	100.0	45.9	19.1	(18.6)	35.0	4.1
1976	100.0	44.6	21.9	(21.3)	33.5	3.9
1977	100.0	41.8	22.4	(21.6)	35.8	3.8
1978	100.0	38.4	23.2	(22.4)	38.4	3.2
1979	100.0	35.8	23.7	(22.9)	40.5	3.8
1980	100.0	34.0	22.6	(21.7)	43.4	5.2
1981	100.0	34.2	21.3	(20.4)	44.5	4.5
1982	100.0	32.0	21.9	(21.1)	46.1	4.4
1983	100.0	29.7	23.3	(22.6)	47.0	4.1

Source: Same as Table 5.
Note: *Primary Industry: Agriculture, Forestry, and Fishery.
Secondary Industry: Mining and Manufacturing.
Tertiary Industry: Electicity, Gas, Water, Construction, Wholesale and Retail Trade, Restaurants, Hotel, Trasportation, Storage, Communication, Financing, Insurance, Real Estate, and Community Social and Personal Services.

TABLE 9

Age Distribution of Employed Persons
in Non-Agricultural Sectors

(Unit: thousand persons, %)

	1965	1970	1975	1980
Total	3,396 (100.0)	4,829 (100.0)	6,405 (100.0)	9,474 (100.0)
14	26 (0.8)	58 (1.2)	52 (0.8)	31 (0.3)
15-19	402 (11.8)	648 (13.4)	772 (12.1)	806 (8.9)
20-24	371 (10.9)	537 (11.1)	826 (12.9)	1,391 (15.4)
25-29	454 (13.9)	620 (11.3)	947 (12.1)	1,396 (12.8)
30-34	501 (14.8)	755 (15.6)	972 (15.2)	1,354 (15.0)
35-39	483 (14.2)	617 (12.8)	912 (14.2)	1,212 (13.4)
40-44	446 (13.1)	557 (11.5)	726 (11.3)	1,055 (11.7)
45-49	303 (8.9)	448 (9.3)	490 (7.7)	822 (9.1)
50-54	203 (6.0)	266 (5.5)	372 (5.8)	492 (5.4)
55-59	123 (3.6)	181 (3.7)	199 (3.1)	294 (3.2)
60+	84 (2.5)	129 (2.7)	137 (2.1)	195 (2.2)
(20-24)/(30-34)	.741	.711	.850	1.027
(20-24)/(40-44)	.832	.964	1.138	1.318
(20-24)/(50-54)	1.828	2.019	2.220	2.827

Source: Same as Table 5.

rate of 7.8 %, respectively. The other impression from the table is that the relative size of younger workers (ages 20-24) to older workers(ages 30-34, 40-44, and 50-54) increased rapidly during the period 1965-80. At the beginning of the period, younger workers accounted for 74.1 %, 83.2 %, and 182.8 % of each older age groups, but at the end 102.7 %, 131.8 %, and 282.7 % respectively, which implies a significant change in age structure in Korean labor force during the 1970s.

B. Interscale Differences in the Labor Market

1. Differences in Capital Intensity

The growth of the Korean economy has been based on an export-promotion strategy that resulted in an average annual growth rate of exports of 39.1 % during the first (1962-66) and the second five-year economic development plan (1967-71), and of 34.9 % during the third (1972-76) and the fourth plan (1977-81), reaching $ 21.3 billion in 1981 from $ 54.8 million in 1962. And the rate of exports to GNP has increased from 6.0 % in 1962 to 43.4 % in 1981. During the first ten years (1962-71) of the economic development plans, the government encouraged investments into labor-intensive industries to expand exports by utilizing the existing pool of labor surplus, as stated earlier. Thus, exports of labor-intensive light manufacturing industries experienced unprecedented expansion during the period.

Most of the expansion took place in large-scale firms, not in small-scale firms. For example, the proportion of workers employed in large firms with 500 workers or more to total employment in manufacturing increased from 25.9 % in 1966 to 35.0 % in 1970 (see Table 10). But the proportion of workers employed in small firms with 5 to 99 workers decreased from 50.0 % in 1966 to 38.9 % in 1970. The proportion of workers employed in medium-size firms with 100-499 workers stayed almost constant or increased slightly. This rapid expansion in numbers of workers in large firms in the 1960s was based on readily available cheap labor, and explicit or implicit government assistance for large-scale production with an intent to utilize economies of scale. On the contrary, small firms were almost neglected and could not expand during the period of rapid industrialization since only a small portion of them are designated as export industries by the government. The export industries designated by the government benefited from tariff exemptions on imported materials used for export production, low interest loans, etc.

On the other hand, during the second ten years (1972-81), the government changed the direction of policy for the third and fourth five-year plans. The government planned investment schedules for such heavy and chemical industries as shipbuilding, electrical and non-electrical machinery, steel and metal products, and petrochemicals, anticipating that Korea would soon experience the increase in wages and have a comparative advantage in these capital-intensive industries, and would be able to export these products. Thus, various government policies have been formulated and

TABLE 10

Employees and Their Composition by Firm Size*

(Unit: thousand persons, %)

Year	Total	Small	Medium	Large
1966#	(100.0)	(50.0)	(24.1)	(25.9)
1968#	(100.0)	(44.3)	(24.4)	(31.3)
1970#	(100.0)	(38.9)	(26.1)	(35.0)
1970	1,084 (100.0)	379 (35.0)	351 (32.4)	354 (32.6)
1972	1,223 (100.0)	527 (43.1)	361 (29.5)	335 (27.4)
1974	1,606 (100.0)	533 (33.2)	513 (32.0)	560 (34.9)
1976	2,023 (100.0)	578 (28.7)	659 (32.6)	786 (38.9)
1978	2,909 (100.0)	851 (29.3)	909 (31.2)	1,149 (39.5)
1980	2,929 (100.0)	971 (33.2)	878 (30.0)	1,080 (36.9)
1982	3,121 (100.0)	1,087 (34.8)	932 (29.9)	1,102 (35.3)
1984	3,695 (100.0)	1,358 (36.7)	1,102 (29.8)	1,235 (33.4)

Source: Ministry of Labor Affairs, Reports on Occupational Wage Survey, various issues.

Note: *"Large", "Medium", and "Small" firms are those with 500 or more, 100 to 499, and 10 to 99 employees, respectively.

Percentages may not add to 100 because of rounding.

#The proportions are calculated from Reports on Mining and Manufacturing Survey, various years.

carried out to encourage capital formulation in those industrial sectors.

Large firms, better equipped with the wealth they had accumulated from light manufacturing during the 1960s, were instrumental in bringing foreign technology into Korea and adapting it with the help of various government policies such as tariff exemptions on imported capital goods used for export production, various types of loans, etc. favorably allocated to them. Smaller firms have acquired these new methods and equipment with a lag by linking up with large firms either through subcontracting arrangements or by marketing agreements.

As shown in Table 10, The proportion of workers employed in large firms to total workers increased from 32.6 % in 1970 to 39.5 % in 1978 and then decreased to 33.4 % in 1984.[2] On the other hand, the proportion in small firms changed the other way round, i.e., decreased from 35.0 % in 1970 to 28.7 % in 1976 and then increased to 36.7 % in 1984. The proportion in medium firms stayed at around 30 % consistently. This distribution of workers to each type of firm size is relatively stable compared to that of the 1960s, which in part supports the argument that large firms increased the use of capital for production instead of simply increasing the use of labor during the 1970s.

Table 11 presents the example of technological dualism and difference in labor productivity between large and small firms (defined differently here), which had resulted in steep interscale wage differentials. The causal relationship is that: capital

TABLE 11

Comparison of Capital Intensities and Productivities of Labor in Manufacturing by Firm Size*

(Unit: thousand Won per worker)

Year	Scale	Tangible Fixed Assets	Machinery & Equipment	Total Assets	Gross Value Added
1970	Large	1,157	630	3,079	637
	Small	374	135	934	338
1972	Large	1,448	765	3,670	882
	Small	391	161	977	418
1974	Large	1,993	1,085	5,504	1,390
	Small	473	191	1,275	600
1976	Large	2,754	1,492	8,041	2,075
	Small	1,447	694	4,263	1,455
1978	Large	3,405	1,759	10,141	2,955
	Small	1,821	832	5,533	2,216

Source: The Bank of Korea, Financial Statements Analysis, various issues, Seoul.

Note: *"Large" refers to the large firms which employ more than 700 workers, and "Small" to the small firms with less than 300 workers.

concentration in large firms --> differences in capital intensities --> differences in labor productivity --> interscale wage differentials. In this argument, therefore, interscale differential in labor earnings will prevail as long as differences in capital intensities exist. This is the prime reason for the differences in labor productivity between large and small firms.

2. Differences in Labor Market Practices

Large firms in general follow the predetermined format of the recruiting process in hiring new workers, based on advertisement of job openings through nation wide newspapers, written and oral examinations for college graduates, and formal interview for other lower level school graduates. On the other hand, small firms hire new workers mainly through the informal channel of personal contacts, preferring workers with extensive past work experience. The hiring standard of large firms is, therefore, much higher than that of small firms. Those from better schools who perform better in the screening process are concentrated in large firms and consequently the quality of workers in general is regarded to be higher in large firms than in small firms.

After recruitment, large firms provide the formal training necessary for capital-intensive technology to their new employees. After a certain length of probationary period, the firms offer internal promotions and tenured status in return for life-time commitments under which employees can be fired only for certain specified reasons. On the other hand, small firms, relying on traditional labor-intensive methods of production, do not offer organized training programs, only informal on-the-job training without a life-time commitment.

C. Wage Policy and Wage System

The Korean labor market is relatively free from heavy governmental intervention or the influence of powerful labor unions. The government exercises little direct influence on the wage rates in the private sector of the economy except for an announcement of a percent increase in government employees' salary in the beginning of every year. The unions, since the 1960s, have expanded the size of membership, but have been ineffective in collective bargaining due to surplus of labor as well as strict governmental restrictions on union activities such as strikes. Furthermore, union activity during the 1970s was completely stopped by a Presidential Emergency Decree in 1971 for national security reasons.

It is generally said that the wage system in Korea is a combination of merit-based reward and seniority-based wage system. The relative importance of the two varies across individual firms, because the relationship between employer and employee is a mixture of contract and paternalism.

Workers in the Korean labor market are paid in most cases on a monthly basis. The concept of the hourly wage is vague. The monthly compensation to workers of regular employment status is generally composed of the following three components: regular payment, overtime payment, and bonus.

The regular payment includes not only the basic payment which is determined by the labor contract based on work experience, sex, education, and overall job performance review, but also various allowances for the cost of living of family, based on the number of worker's dependents.

The overtime payment usually takes the form of a fixed monthly compensation for a contracted number of hours of overtime work, rather than for actual overtime work based on a regular payment. The share of overtime payment in total monthly earnings varies among firms and industries, and usually increases with firm size and decreases with worker's educational level as shown in Table 12.

The bonus system is a product of the paternalistic employment relationship. In most cases, the amount of bonus to be paid is not specified in the labor contract and is an informal agreement between employees and employer. Almost all the firms pay some bonus. There is, though, a wide discrepancy among firms and industries both in frequency and in the amount paid, depending on business performance and/or employees' achievement. Changes in the bonus payment are likely to create much less resistance from workers than changes in the regular payment since they regard the bonus as a special separate payment made by the employer for their achievement. Thus, the bonus payment is more sensitive to business conditions than the regular

TABLE 12

Decomposition of Total Monthly Earnings by Firm Size* and Education Level in 1978#

(Unit: Won, %)

	Total Monthly Earnings per Employee@	% Breakdown of Payments			Bonus Rate
		Regular	Overtime	Bonus	
All	104,132	73.7	15.2	11.1	180.0
Primary	67,606	70.5	23.1	6.3	107.7
Middle	76,696	69.5	22.4	8.2	141.0
High	116,898	74.5	13.0	12.5	201.7
Junior Coll.	174,469	79.9	7.5	12.6	189.7
College	269,998	79.3	4.9	15.8	239.6
Small Firms	100,832	81.7	9.2	9.1	134.2
Primary	60,644	78.4	17.7	3.9	59.0
Middle	72,810	79.0	15.5	5.5	83.5
High	111,391	82.9	6.5	10.5	152.3
Junior Coll.	172,014	84.4	3.9	11.8	167.4
College	244,876	84.0	2.5	13.5	193.4
Medium Firms	99,829	73.8	16.4	9.7	158.3
Primary	65,877	45.7	16.5	3.8	99.0
Middle	75,560	70.8	22.4	6.8	115.8
High	116,129	74.8	13.9	11.3	181.0
Junior Coll.	172,286	79.3	8.6	12.1	182.9
College	268,564	79.7	5.6	14.7	221.7
Large Firms	110,612	67.8	18.7	13.5	239.9
Primary	78,280	64.4	26.2	9.3	173.6
Middle	79,721	63.7	26.0	10.3	194.8
High	122,080	67.8	17.3	14.9	263.9
Junior Coll.	180,400	74.6	11.0	14.3	230.7
College	297,565	74.9	6.4	18.7	299.3

Source: Administration of Labor Affairs, Report on Occupational Wage Survey, 1978.

Note: *Definition of firm size is same as Table III-9.
#Regular payments, overtime payments, and bonus are the proportions to total monthly earnings in percentage.
Bonus rate is the percentage ratio of bonus to regular payments, i.e., ((Bonus * 12) / monthly regular payments)*100.
@The foreign exchange rate in 1978 was 484 won per U.S. dollar.

payment.

The share of monthly average bonus payment in total monthly earnings in 1978 increased both with firm size and with the level of education, as indicated in Table 12. The bonus rate, which is the percentage ratio between monthly regular payment and annual bonus payment, ranged from 59.0 % for primary school graduates in small firms to 299.3 % for college graduates in large firms.

FOOTNOTES

1. Mean ages at first marriage for females increased considerably from 20.4 in 1955 to 21.6 in 1960, 22.8 in 1966, 23.3 in 1970, 23.6 in 1975, and 24.1 in 1980.

2. There is an exceptional case of the year 1972, which is excluded in the statement for comparison among three types of firm size.

CHAPTER IV

THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

A. Choice of An Approach

As stated in Chapter II, the production function approaches have their disadvantages: simplicity in the case of CES considering only two factor inputs, and measurement and specification errors for a factor such as capital in the case of TL. Especially, the specification of age groups in the labor force for either the TL or CES production function is not only difficult but can also easily lead to sharp differences in the estimates of production parameters and elasticities of substitution between age groups, because all workers in a category are assumed to be perfect substitutes for each other.[1] In addition, the TL production function approach can not be readily modified to allow for the effect of cyclical factors (Freeman, 1979; Martin, 1982) and changes in the structure of an economy (Lin, 1982; Mosk and Nakata, 1985), which are expected to be important in determining the relative earnings especially in developing countries.

This study, therefore, uses the human capital approach to estimate the log earnings function in the case of Korea with the variables of cohort size (C(X)) and the interaction of experience and cohort size (X*C(X)), initially defined by Welch (1979), for the examination of effects of changes in the magnitude of cohort size on earnings over the life cycle.

The human capital approach is the only one to date which directly addresses the question about the effects of cohort size on earnings and earnings growth by estimating C(X) and X*C(X). Only the effects of cohort size on earnings levels can be estimated in the other approaches. In addition, a conventional production function might be considered to specify the relationship between cohort size and earnings only with labor without capital in the human capital approach. Although this approach has been used by Welch (1979) and Lin (1982), it has the disadvantage of ignoring substitution between schooling classes with the variable C(X) measured separately for each schooling classes' earnings profiles. It is possible to consider the substitution between workers in different schooling classes by measuring the different cohort size from that Welch defined. If both college graduates and high school graduates are included in the denominator of the cohort size measure, then the possibility of substitution between the schooling classes can be recognized. This will be discussed more in the section D in Chapter IV.

Based on Freeman's (1977) argument that age-earnings profile generated with cross-section data no longer provides reliable indicators of possible lifetime income paths, pooled time-series analysis with data aggregated by single experience should be reasonable for the estimation of earnings function, especially for the examination of the cohort size effect on earnings. Grant and Hamermesh (1981) used cross-section data for the analysis of the cohort size effect in the manufacturing sector in the U.S. by using the TL production function, while others used pooled time-series data to analyze the effect in the whole country. Welch (1979) used pooled time-series of aggregated data for the U.S. in his human capital approach. In addition, Mosk and Nakata (1985) find the differences in the structure of age-wage profiles among three types of firm size (small, medium, and large firms), by estimating each relative wage equations (CES approach in my categorization) with time-series data in the Japanese labor market.

Thus, by estimating earnings equations separated by firm size within the human capital approach, the pooled time-series analysis of the effect of cohort size on earnings and earnings growth in non-agricultural sector of Korea will contribute to this field, compared to the past researches for the developed countries.

B. Negative Effect on Earnings

In this section, the human capital theory and the conventional production function will be linked in an effort to specify the relationship between cohort size and earnings, following Welch's (1979) model of career phases based on the optimal life-cycle configuration suggested by Rosen (1972).

The simplest view of the way cohort size affects earnings follows from the notion that work careers consist of a series of more or less distinct phases in production. A worker enters as a raw recruit or learner, first achieves junior membership, and somewhat later a senior membership in the profession. Only if all workers at different stages of the career substitute perfectly for each other, will the structure of earnings be independent of cohort size. However, if different types of workers with varying levels of experiences do different kinds of jobs or tasks, these jobs or tasks might not be perfect substitutes for one another. If so, then the value of each activity would reasonably depend on the number of people doing it, and cohort size would matter. Each activity is productive, and marginal productivities are determined by the number of workers engaged in all activities.

Consider an aggregate production function of the form:

(4.1) $Y = f(N, Z)$,

where N refers to the productive effort of persons in a given profession. Those things contained in Z are all other factors that are not included in N and are assumed to be weakly separable[2] from N in the production function, so that N is only illustrative in the following discussion.

The total effort, N, is itself a function of numbers of workers in each of several worker types.

(4.2) $N = g(N_1, N_2, \ldots .)$,

where the number of workers of each type is the number of members of the profession devoting their effort to that type of activity. In the optimal life-cycle configuration suggested by Rosen (1972), a worker solves for an optimal sequence of position progress rates by recognizing that each position level corresponds to learning options that affect performance in sequential position levels. Thus, a worker at any sequential career phase is involved in the process of transition from lower toward senior worker activities.

If n(X) refers to the number of members of the profession with X years of work experience, then the number of workers of type j is given by:

$$(4.3)\quad N_j = \int_{X_{j-1}}^{X_j} (1-P_{j-1}(X))n(X)dX + \int_{X_j}^{X_{j+1}} P_j(X)n(X)dX ,$$

$$0 \leq P_j(X) \leq 1, \quad X_j \leq X \leq X_{j+1},$$

where P_j denotes the part of their working time spent in activity j with X years of work experience. That is, as a worker enters the i^{th} career phase he initially devotes full time to the i^{th} activity and at that moment begins transition into the $i+1^{st}$ activity. As the i^{th} phase progresses the proportion of time spent in the i^{th} activity decreases until at the end of the phase all of his time is devoted to the next activity and a new phase begins.

In the competitive market, the wage a worker receives equals his marginal product. The wage of those with X years of experience is:

$$(4.4)\quad W(X) = \frac{\partial f}{\partial n(X)} = \frac{\partial f}{\partial g}\left(\frac{\partial g}{\partial N_i} \cdot \frac{\partial N_i}{\partial n(X)} + \frac{\partial g}{\partial N_{i+1}} \cdot \frac{\partial N_{i+1}}{\partial n(X)}\right)$$

$$= f_1 \ (g_i P_i + g_{i+1} P_{i+1})$$

This assumes that changes in f_1 are neutral across experience groups and f_1 determines levels but not shapes of the experience-earnings profiles. In analyzing cohort size effect, f_1 can be ignored.

$$(4.5) \quad W(X)/f_1 = P_i g_i + (1 - P_i) g_{i+1}, \text{ where } 1-P_i = P_{i+1}$$

Effects of cohort size on (own) wages are given by the quadratic form:

$$(4.6) \quad \frac{\partial W(X)/f_1}{\partial n(X)} = (P_i, 1-P_i) \begin{pmatrix} g_{i,i} & g_{i,i+1} \\ g_{i,i+1} & g_{i+1,i+1} \end{pmatrix} \begin{pmatrix} P_i \\ 1-P_i \end{pmatrix} = P'H_{ij}P < 0$$

If the total effort, $N = g\ (N_1, N_2, \ldots.)$, is (quasi-) concave, then the Hessian matrix H_{ij}, or the quadratic form $P'H_{ij}P$ of the equation (4.6) is negative definite, which means that the production function, $Y = f(N, Z)$, is (quasi-) concave, too. That is, larger cohorts in the labor force would result in relative wage reductions and vice versa if there are more than two factors in $g(.)$. If positive cohort size effects on (own) wages are obtained, then the concavity of the production function no longer holds.

For simplicity consider the two-factor constant elasticity of substitution case (CES production function form),

$$(4.7) \quad g = (\delta_1 N_1^{-\beta} + \delta_2 N_2^{-\beta})^{-1/\beta},$$

where $S_{12} = 1/(1+\beta)$ is elasticity of substitution between N_1 and N_2. In this case there are only two activities, learner (N_1) and worker (N_2), and the life cycle can be viewed first as one of transition from learner to worker followed by a period as a fully vested worker. In this example,

$$(4.8) \quad \frac{\partial W(X)/f_1}{\partial n(X)} = - \frac{1}{S_{12}} \theta N_1 N_2 (P/N_1 - (1-P)/N_2)^2$$

where $\theta = g_1 g_2/N$ and $P = P(X)$ is the function of time, at X, spent as a learner.

Several points deserve note in the equation (4.8). Effects of increased cohort size are inversely proportional to the elasticity of substitution. The substitution elasticity indexes worker-learner differences in the nature of jobs performed. Greater similarity of activities implies greater substitutability. It is likely that the substitution elasticity is related to the transition function, P(X). Rapid transition from learner to worker status implies that learners can easily adapt to worker tasks. It is expected that when transition occurs easily, worker-learner tasks are more similar, that is, workers and learners are better substitutes. This leads immediately to predictions across the types of firm size (small, medium, and large firms) of differences in worker-learner substitution elasticities. As technology of a firm becomes more capital-intensive, a higher degree of specialization, as well as independence of labor on performing a task, is required. It is a near tautology that those who are employed in large firms, whose technology becomes more capital-intensive than small firms in Korea, transit less rapidly from learner to worker status after beginning work, and it is likely that worker-learner substitution elasticities are smaller than for those who are employed in small firms.

C. Indeterminate Effect on Earnings Growth

Human capital theory assumes that each individual maximizes his present value of earnings stream by allocating an optimal amount of resources to expenditure on human capital investments such as education and training on the job.

The human capital theory attributes observed earnings growth to returns on investments in human capital that increase a worker's earnings. An individual chooses a level of investment over a given period of time by comparing the costs of investment, which consist of forgone current earnings and purchased goods and services, and the benefits in the form of higher expected future earnings. The effect of cohort size on earnings growth therefore ultimately depends on the influence it has on the costs and benefits of investment in human capital. If individuals in larger cohorts tend to invest in greater amounts of human capital, the observed earnings growth will be greater than that of individuals in smaller cohorts and so their experience-earnings profiles will be steeper than those of smaller cohorts. On the other hand, if larger cohorts invest less, then their earnings profiles will be flatter.

As stated in Chapter II, Welch (1979) assumes that the returns are greater than the costs in larger cohorts, emphasizing on the reduced costs of human capital investments because of depressed earnings levels. That is, if large entering cohorts depress earnings, then the opportunity cost of on-the-job training is depressed on entry and cost incentives are to speed learning. But, Berger (1984, 1985) assumes the opposite, emphasizing the increased cost per worker of a given level of investment activity in larger cohort because of the increased value of a trainer's time. If a large cohort of younger workers enters the labor market, the value of a trainer's time increases as total demand for training increases. Since trainers are likely to be senior workers, they also become more valuable in production activities and must be compensated for these forgone earnings.

But, the effect of cohort size on human capital investments can not be determined a priori. Both costs and benefits may increase or decrease with cohort size, and workers in larger cohorts may therefore have higher or lower levels of human capital investment than workers in small cohorts. The uncertain effects of cohort size on the costs and benefits of human capital investments are also apparent from the firm's point of view instead of an individual's. In some firm-specific training, workers and firms would share the cost of these investments. When a larger cohort of young workers appears, firms may react by reducing their investments in specific training per worker. This may imply a decrease in total amount of training workers receive or simply a decrease in the share of the cost borne by the firm. The latter case would raise the cost of training to the worker but also presumably increase the returns. Thus, the effects of cohort size on earnings growth is still indeterminate from a human capital perspective, depending on the relative magnitudes of the effects on the benefits and costs of investments. The relationship can be determined only by empirical examination.

The effects of cohort size on the costs and benefits of human capital investment through training may be different between large and smaller firms.

Becker (1962, 1975) has introduced the distinction between general and specific training into the analysis of investment in human capital. Completely general training, which raises the marginal productivity of worker by the same amount in the firm of employment as well as in other firms, does not allow the firm providing the training to collect returns and thus it is offered only if the firm does not have to pay any of the training costs. On the other hand, completely specific training, which is only useful in the firm providing training, is offered only if its costs and returns are shared between the trainee and the firm since quits by workers or layoffs by the firm inflict capital losses on the other side. In reality, most training received by each employee lies between those two extremes. However, in Korea, large firms are assumed to offer more firm-specificity of training and smaller firms to offer more general one. This is based on the comparison of differences in capital intensity and market power (product market as well as labor market) between the large and small firms in Chapter III.

As the technology of a firm becomes more capital-intensive, a higher degree of specialization, as well as independence of labor, is required. Thus, workers must be familiar with the particular process of production activity and must be able to work effectively with the given members of a team. The training to make workers familiar with the idiosyncratic process of production activity tends to be firm-specific. Also the ability to work with given co-workers with good team work is firm-specific human capital since it is not transferable to other firms (Doeringer and Piore, 1971, p. 16).

In contrast to the workers in the firm with capital-intensive technology, workers in the firm with labor-intensive technology rely primarily on their manual skills to perform their jobs and they tend to be trained to perform various tasks in the production process. Thus, their skills may be easily marketable and almost as useful in other firms as in the firm which provides the training.

Finally, the specificity of training depends on the presence of transaction costs in labor markets (Rosen, 1977, p. 19). Large transaction costs in labor markets prohibit workers from moving their workplace and raise incentives for investment in specific human capital.

The inputs for training include the trainee's time for learning, the trainer's time for teaching, other worker's wasted time due to the interruption of production process during training, and the equipment and materials used for training. Large firms' specific training, during the continuous production processes with independent labor, requires more wasted time from other workers. Moreover, as labor is specialized and the training becomes more firm-specific, the number of trainees per trainer tends to decrease and thus economies of scale in training cannot be utilized (Doeringer and Piore, 1971, p. 14).

> Skill specificity has two effects important in the generation of the internal labor market: (1) it increases the proportion of training costs borne by the employer, as opposed to the trainee, and (2) it increases the absolute level of such costs. As skills become more specific, it becomes increasingly difficult for the worker to utilize elsewhere the enterprise-specific training he receives. This reduces the incentive for him to invest in such training, while simultaneously increasing the incentive for the employer to make the investment. Skill specificity tends to increase the absolute cost of training (regardless of who provides it) because the less prevalent a skill in the labor market, the less frequently training for that skill is provided, and economies of scale in training cannot be realized. Both of these effects encourage the employer to seek reduced labor turnover.

From the above perspective, the absolute cost of training increases with increased specificity of training, and the rate of increase in earnings from the additional years of firm service would be lower in large firms which require more firm-specific human capital investment.

In summary, it is argued that even though the effects of cohort size on earnings growth is indeterminate a priori, the earnings of large cohorts employed in smaller firms grow more rapidly than those of the cohorts employed in large firms, based on the human capital perspective.

D. Model Specification

In order to investigate cohort size effects on earnings profiles, monthly earnings equations are estimated for full-time male workers with the data from Occupational Wage Surveys of Korea covering the period from 1972 to 1982 by two years intervals. Only male workers are considered in this study. Female workers whose working lives are characterized by frequent interuptions and short durations of employment related to child bearing and child rearing require longitudinal labor force participation data not available at this time.

In much of the work on age-experience profiles of earnings, it has been assumed that the shape of the profile does not change over time. But it might be useful to decompose the earnings (log of real earnings) of a cohort with a given level of schooling into an experience component, a period component and a cohort component in order to understand the dynamics of the earnings profiles.[3] The experience component could be interpreted as the return on net investments on the job; the period component would result from investment in the machinery and equipment and from changes in the organization of work, which in turn changes the productivity of all age groups; and the cohort component could, for instance, depend on the size of the cohort and on the quality of schooling. If the three components are additive, the experience component will explain the general profiles of earnings, rising with experience at a declining rate. The period component will not influence the shape of cross-sectional earnings profile but only induce parallel shifts. Excluding individual investments in on-the-job training, it has been common to regard investments in machinery, buildings and other activities that promote productivity and growth. They affect all age groups equally, and yield cross-sectional profiles that are stable in shape and exhibit parallel shifts depending on the growth of the economy.

The cohort component will contribute to the shape of cross-sectional profiles. According to the theory, an increase in the quality of schooling will result in a relative increase in the earnings of young people and thus give a flatter cross-sectional profile.[4] If this quality increase is persistent, it will eventually include all active cohorts and the whole profile is shifted upward so that the shape it had before the first cohort with higher quality schooling entered the market will be regained. Similarly, if the size of new cohorts increase, their relative earnings will decrease. Suppose all active cohorts have achieved the new size. Then the whole profile would regain its old shape but at a relatively lower level. If the increase in cohort size were a temporary phenomenon, it would first increase the cross-sectional slope and then decrease it. In summary, when there is limited substitution between workers of different experience groups, the cohort component of earnings becomes important. An increased supply of younger labor would lead to a relative decrease in earnings for these cohorts and the slope of the cross-sectional earnings profile would increase. An increase in demand for new graduates would have the opposite effect.

To estimate the above three effects on real earnings, pooled cross-section and time-series data are used. Thus, the empirical model extends in both years of experience and time dimensions. The model estimated stems from the general model of the natural log of wage rates:

$$(4.9)\ \ln W_{it} = X_i\alpha + Y_{it}\beta + Z_t\gamma + u_{it},$$

where W_{it} = real earnings of those who have i years of experience at time t. Here X_i is a vector of explanatory variables fixed for a cross-section over time; Y_{it} is a vector of variables fixed that varies over both cross-section and time; Z_t is a vector of variables fixed for a given time period. Under the assumption of an additive period effect (no allowance for an interaction between period and experience component) on real earnings, which will only induce parallel shifts of the earnings profiles, Z_t can be treated as variables of period component in earnings equations.

The period effect will be eliminated to emphasize the experience and cohort effects on earnings in the model. If there is a misspecification of variables, in other words, omission of some relevant variables of period component of Z_t from the regression equation, it could yield biased and inconsistent parameter estimates of other variables, unless the correlation coefficients between included and omitted variables are zero (see Pindyck and Rubinfeld (1981), pp. 128-129). In reality, we can never be sure that the correlation coefficients are zero, or some variables specified for the period effects are correct and capture the parallel shifts of earnings profiles over time, completely.

To eliminate the period effects on real earnings, the log of real earnings with s years of experience is specified from equation

(4.9) as follows:

$$(4.10)\ \ln W_{st} = X_s\alpha + Y_{st}\beta + Z_t\gamma + u_{st}.$$

By subtracting (4.10) from (4.9), the earnings equation is that:

$$(4.11)\ \ln(W_{it}/W_{st}) = (X_i - X_s)\alpha + (Y_{it} - Y_{st})\beta + (u_{it} - u_{st}).$$

The regressors for the period effects (Z_t) on real earnings are eliminated.

The specific form that equation (4.11) takes for estimating for each of the education groups of male workers by firm size is:

$$\begin{aligned}(4.12)\quad \ln (W_{it}/W_{st}) = {} & b_1(EXPER_i - EXPER_s) \\ & + b_2(EXPER_i^2 - EXPER_s^2) \\ & + b_3(COHORT_{it} - COHORT_{st}) \\ & + b_4(EXPER_i * COHORT_{it} - EXPER_s * COHORT_{st}) \\ & + b_5(POPW_{it} - POPW_{st}) \\ & + e_{it},\end{aligned}$$

where W_i = monthly labor earnings for those who have i years of experience,

W_s = monthly labor earnings for those who have s years of experience (s=1 in this study),

EXPER = years of experience,

COHORT = weighted cohort size of workers,

POPW = proportion of production workers, and the subscripts of i and t represent years of experience and time, respectively. The intercept term, say, b_0 is forced to be zero. If $i = s$ the expectation of right hand side (RHS) of the equation (4.12) is equal to b_0, i.e., $E(b_0 + e_{st}) = b_0 + E(e_{st}) = b_0$. The left hand side (LHS) is also equal to zero, i.e., $E(\ln(W_{st}/W_{st})) = 0$. Thus, the intercept term should be zero based on E(LHS) = E(RHS).

The empirical model used here is different from others in this human capital approach in terms of the period effects which are eliminated to avoid specification error. The period effects, which induce parallel shifts of cross-sectional earnings profiles, are captured only by the aggregate unemployment rate for white males and a time trend in the case of Welch's (1979) and Berger's (1985), and the business cycle indicator and a time trend in the case of Lin's (1982). But, we can never be sure that these two variables would completely capture the parallel shifts of earnings profiles over time.

$EXPER_i$ and $EXPER_i^2$ are the variables of experience component (X_i), $COHORT_{it}$ is the variable of cohort size in cohort component (Y_{it}), and the interaction between experience and cohort components are allowed by introducing the variable of $EXPER_i*COHORT_{it}$ in the equation (4.12).[5] $POPW_{it}$ is introduced to control for the different patterns of demand for human capital investment between production and non-production workers, which will be stated later in this section.

Total monthly earnings, which include regular payments, overtime payments and monthly average bonus, are used instead of the hourly wage rate as a numerator of dependent variable in the estimation of the earnings equations since, as discussed earlier, the concept of hourly wage is vague in Korea. Total monthly earnings for those who have one year of experience are used, without any specific reason, as a denominator of the dependent variable, which changes over time, but not in cross-section.[6]

Thus, the wage ratio (W_{it}/W_{1t}) is used as a dependent variable for the earnings equations to emphasize the cohort size effect, which influences the shape of cross-sectional profiles, among the three components (experience, cohort, and period components) included in the dynamics of experience-earnings profiles over time.

Berger (1985) points out that Welch's (1979) regression equations have several restrictions on the estimated parameters, due to the spline variable (S) (see equation (2.9) in Chapter II). The parameters of X*D and X*lnC(X)*D are restricted to be constant multiples of the parameters of D and lnC(X)*D, respectively. The parameter estimate of X*lnC(X) is restricted to equal zero for workers with experience greater than the level of experience (a) at which an individual becomes a fully-vested worker. This level is assumed to be exogenous and given. Also, the parameter estimate of X^2 is restricted to be equal over the life cycle. Thus, while the effects of cohort size and experience are allowed to vary over the life cycle, they do so only in a very limited manner. If these restrictions are relaxed, then the analysis of cohort size effects must take place within the separate subsamples of younger workers and older, more experienced workers.

Variation in earnings growth due to differences in cohort size is likely to be important only among workers still pursuing training activities, because older workers who have completed their human capital investments have already adjusted the amount of their training in response to cohort size. Any remaining differences in earnings growth among these workers are likely to be the result of the influence of other variables, since most human capital investments take place early in a worker's career. Also, the likely presence of uncontrolled cohort effects other than cohort size effects makes it inadvisable to project the future experiences of the baby-boom cohorts. The uncontrolled cohort effects would be the effects from shifts of demand side, for example, gradual increases in quality of schooling or capital. The former would increase demand for younger workers and so increase their wages, but the latter for older (or skilled) workers if older labor is relatively more complementary to capital than younger workers. This is less likely to be a problem within the relatively narrow band of birth cohorts covered in the younger worker subsamples.[7]

Thus, the best test of the effect of cohort size on earnings growth can be obtained by restricting the estimation to younger workers, who have less than 15 years of work experience in this study and are still pursuing training.

In order to address questions of differences in the effects of cohort size on experience-earnings profiles for each firm size and education level, the earnings equations are regressed for three types of firm size: small, medium, and large firms; and three schooling groups: primary and middle school, high school, and college graduates. The experience-earnings profiles are captured by experience ($EXPER_i$) and experience squared ($EXPER_i^2$). In conventional human capital semi-logarithmic wage equations, $EXPER_i$ and $EXPER_i^2$ are both used to approximate the concavity of the profiles. Because the optimal pattern of human capital investments in on-the-job training for individuals suggests that later investments are less profitable than earlier ones, human capital investments would be expected at the early stage of life. The investments would then decline after this stage. Corresponding to changes in human capital investments over the life cycle, the observed earnings of the individual workers rise initially with experience, peak, and then fall thereafter. Thus, the coefficient of $EXPER_i$ (b_1) is expected to be positive and the coefficient of $EXPER_i^2$ (b_2) negative.

The measure of cohort size used incorporates not only workers with a particular experience, but also the set of workers with surrounding experiences. It seems likely that wages of a particular cohort are affected both by its own size and by the size of surrounding cohorts as well. In particular, the measure is:

$$(4.13) \quad COHORT_{it} = \sum_{k=-2}^{2} w_k (N_{i+k,t} / N_t),$$

where w_k=(1/9, 2/9, 3/9, 2/9, 1/9), except for recent entrants in which succeeding cohort fractions are not defined. In this case, the weights are scaled so as to sum to one. Individuals of adjacent experiences are included in the numerator since these workers are probably very close substitutes and essentially in the same cohort.

Each of the five experience groups in the measure is given "V" rated weights. The denominator is the total number of individuals at time t.

This measure attempts to deal with the fact that workers with different amounts of schooling and in different firm size are substitutable to some degree. For example, if the number of workers at a particular schooling level increases, the cohort size for workers at the remaining schooling levels decreases, and is likely to experience a wage increase.

The experience-cohort size interaction variable ($EXPER_i$*$COHORT_{it}$) in the earnings equation provides a test of relationship between early career earnings and cohort size: that is,

$$(4.14)\quad \partial \ln W_{it}/\partial EXPER_i = b_1 + 2b_2 EXPER_i + b_4 COHORT_{it}$$

If earnings grow at faster rates in larger cohorts, then the estimated coefficient (b_4) on the interaction variable should be positive. On the other hand, if this coefficient is negative, then cohort size effects on earnings increase as workers age.

The characteristics of jobs in different market, characterized by occupation in this study, may lead to different patterns of demand for human capital investment and therefore of experience-earnings profiles. If each job offers investment opportunity in different types of human capital and each individual's human capital productivity varies with the type of human capital, an individual's earnings profile would change according to the job he chooses, thereby changing the aggregate earnings profiles. Furthermore, if we divide workers into production workers and non-production workers, the proportion of either worker types in a cohort with the same experience may affect the aggregate earnings, because of their earnings differentials. Since it is possible that differences attributable to occupational class might be added to differences due to cohort size when all occupational groups are lumped together in the estimation of within-sector aggregate earnings equations, the sample is divided into two broad occupational categories: production and non-production workers, and the proportion of production workers within an experience-year cell is introduced into the earnings equations.[8] Also, this variable controls for selectivity bias in computing average earnings. This effect is expected to be negative in Korea, because non-production workers' wages are generally higher than production workers' with the same experience and education.

FOOTNOTES

1. Stapleton and Young (1984) point out in detail the drawbacks of categorization of labor force comparing with their multiple skill model.

2. The weak separability is the most popular assumption in a production function. When the groups N and Z in the function $Y = f(N, Z)$ are independent each other, it can be represented by sub-production functions for the groups of $N = g_1(n_1, n_2, \ldots)$ and $Z = g_2(z_1, z_2, \ldots)$. Under the assumption of strong separability or block additivity, the production function is also made up sub-production functions for each groups, but unlike weak separability, i.e., $Y = f(g_1(n_1, n_2, \ldots) + g_2(z_1, z_2, \ldots))$. The strong separability is the most popular assumption about preferences in a utility function (see Deaton and Muellbauer (1983), pp. 127-142).

3. Identification of the three components has been discussed in e.g. Mason et al. (1973) and Hanoch (1982).

4. It is assumed that demand for the services produced by new cohorts is elastic.

5. Welch's annual earnings equation allows for separate cohort size, experience and period effects while also controling for other factors. Period effects are captured by the aggregate unemployment rate for white males, a time trend, and the proportion of each experience-sample year cell not working, which also controls for selectivity bias, as does a variable measuring the proportion of each cell having its income imputed by the Census Bureau (see equation (2.9) in Chapter II).

6. I regressed the equations by using the earnings of those who have other years of experience than one year of experience as a base, but the coefficients of explanatory variables in the regressions were almost same as the results reported.

7. Recall that the key identifying assumption is that the only cohort effects on earnings are cohort size effects. While this may be plausible across narrow bands of entry year cohorts, it may not be across wide bands. Any number of factors such as school quality not otherwise controlled for in the model may vary across wide bands of entry year cohorts. If so, one way to control for cohort effects other than cohort size is to estimate earnings equations for relatively narrow bands of entry cohorts.

8. The categories of production workers are here production workers, transportation and equipment operators, and laborers. In other words, professionals, technologists, administrative and managerial workers, clerical workers, sales workers, and service workers, are implicitly included in non-production workers in this analysis.

CHAPTER V

DATA AND EMPIRICAL RESULTS

A. Data

In this study, raw data from the 1972, 1974, 1976, 1978, 1980, and 1982 Occupational Wage Surveys of Korea, conducted under the sponsorship of the Ministry of Labor Affairs, have been used for the pooled time-series analysis of the effect of cohort size on earnings for the non-agricultural sector in Korea. The surveys are the systematic and stratified samples of full-time workers with a sample error of less than 5 percent. Each survey has a sample size of approximately 300,000 individuals employed by firms with more than 10 workers and collected various kinds of information on the full-time workers. For instance, sex, age, educational attainment, professional classification of the job description, years of experience, years of employment, numbers of days worked, numbers of hours worked, total payments, regular payments, overtime payments, bonus, location of the firms or enterprises in which the respondent is employed, industry classification of the firm, size of the firm, number of respondents in each firm, etc.

The major purpose of the surveys is to provide vital labor statistics for the studies of labor earnings and the structure of wages in the Korea's labor market. The survey has been carried out since 1968, but some changes have been made in sample sizes, ranges of survey coverage, and the categorization of firm size, but all of the variables in the earnings equation specified earlier are categorized and aggregated consistently over time. The sample is, thus, segmented into three schooling completion groups (primary and middle school, high school, and college graduates), and within each group the data are aggregated into 15 experience and 6 year groups by firm size(3) yielding 270 total cells.

The surveys reported the level of formal education completed, not the years of schooling for each individual, i.e., the level of education last completed was reported in the case of a dropout. The levels of education reported in the surveys changed from four levels (primary school, middle school, high school, and college graduates) to five levels (four levels before plus junior college graduates) in 1975 to four levels again by combining primary and middle school graduates in a category in 1980. Thus, three education levels (primary and middle school, high school, and college) are used in this study, by adding primary and middle school graduates for each level of experience, which implies that there is no big wage differential between them[1] and it is assumed that they are perfectly substitutable in production. Junior college graduates are excluded in this analysis, because this group would bias the coefficient of cohort size variable due to small number of observations in each survey. However they are included in the denominator in the calculation of cohort size variables with the idea that they are substitutable to other workers with different amount of schooling to some degree.

Firms are categorized into three groups as usual with consistency over time. Large firms are defined to be the firms with more than 500 employees, medium firms to be those with 100-499 employees, and small firms to be those with 10-99 employees.

The surveys report two types of work experience: years of experience within current type of occupation and years of service with current employer in current occupation. The former is used as a definition of years of experience in this analysis, because a worker's past experience in the same occupation is supposed to affect productivity and his wage in a firm currently employed.

The mean values and standard deviations of the variables in regressions are reported in Table 13.

B. Empirical Results

The regression results for the earnings equations are shown in Tables 14, 15, and 16, for primary and middle school, high school, and college graduates, respectively. The results are presented by firm size and education level, since we are interested in comparing the effects of cohort size on earnings profiles in large firms with those in small and medium firms with a given level of schooling.

With the data arrayed across experience levels and across years, that is, pooled cross-section and time-series data, there may be cross-sectionally heteroscedasticities and time-wise

TABLE 13

Means and Standard Deviations of Variables*

Variables	Small Firms	Medium Firms	Large Firms
Primary and Middle School Graduates			
(1)	0.2704 (0.290)	0.7072 (0.695)	1.5354 (1.309)
(2)	-0.5279 (0.399)	-1.2099 (0.897)	-2.2505 (1.827)
(3)	1.2318 (0.599)	3.4041 (1.633)	7.7483 (3.577)
(4)	0.4335 (0.560)	1.4869 (1.525)	3.9624 (4.068)
(5)	82.768 (5.472)	87.240 (4.430)	91.015 (3.930)
(6)	-1.4330 (3.496)	-1.6470 (3.400)	-3.0240 (3.004)
High School Graduates			
(1)	0.1520 (0.124)	0.4375 (0.367)	1.2723 (1.047)
(2)	-0.2230 (0.171)	-0.6282 (0.506)	-1.7630 (1.616)
(3)	0.7719 (0.301)	2.1764 (1.037)	6.3829 (3.643)
(4)	0.3968 (0.337)	1.1108 (1.199)	3.3476 (4.228)
(5)	37.546 (7.306)	51.555 (6.875)	63.420 (8.650)
(6)	-4.4443 (8.227)	-6.5232 (5.923)	-9.7856 (7.680)
College Graduates			
(1)	0.0818 (0.053)	0.2188 (0.159)	0.4850 (0.336)
(2)	-0.0687 (0.064)	-0.1982 (0.181)	-0.5308 (0.479)
(3)	0.4811 (0.198)	1.2208 (0.585)	2.6181 (1.187)
(4)	0.3306 (0.181)	0.8039 (0.571)	1.6023 (1.322)
(5)	2.3478 (2.438)	3.2452 (2.846)	5.3124 (5.103)
(6)	-1.2455 (2.028)	-1.6696 (2.620)	-1.3183 (3.790)

Note: *The names of the variables are as follows; (1) $COHORT_{it}$
(2) $COHORT_{it}-COHORT_{1t}$ (3) $EXPER_i*COHORT_{it}$
(4) $EXPER_i*COHORT_{it}-EXPER_1*COHORT_{1t}$ (5) $POPW_{it}$
(6) $POPW_{it}-PCPW_{1t}$.
All values are multiplied by 100.
Standard deviations are reported in parentheses.

TABLE 14

Regression Results for Primary and Middle School Graduates

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0794 (8.404)	0.0945 (10.51)	0.0988 (15.83)
$EXPER_i^2$	-0.0023 (3.605)	-0.0022 (3.262)	-0.0028 (6.747)
$COHORT_{it}$	-18.131 (2.376)	-8.5437 (2.346)	-1.8256 (2.402)
$EXPER_i*COHORT_{it}$	1.5885 (2.351)	0.8656 (2.571)	0.3369 (3.101)
$POPW_{it}$	-0.2733 (2.255)	1.1434 (6.346)	-0.2868 (1.918)
Buse R^2	0.9370	0.9414	0.9576
S.E.E.	0.9692	0.9751	0.9678
N	90	90	90

Note: The absolute values of t-statistics are in parentheses. The Buse R^2 is the goodness of fit in GLS estimation (see Buse (1973)).

TABLE 15

Regression Results for High School Graduates

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0831 (24.92)	0.0844 (19.87)	0.0573 (9.374)
$EXPER_i^2$	-0.0026 (11.48)	-0.0022 (7.940)	-0.0010 (2.271)
$COHORT_{it}$	0.5046 (0.067)	-5.7002 (1.867)	-5.6105 (4.883)
$EXPER_i$*$COHORT_{it}$	0.9297 (1.413)	0.8479 (3.064)	0.2940 (2.593)
$POPW_{it}$	-0.6830 (9.437)	-0.1920 (1.957)	-0.5939 (5.659)
Buse R^2	0.9719	0.9595	0.9692
S.E.E.	0.9891	0.9633	0.9698
N	90	90	90

Note: The absolute values of t-statistics are in parentheses.

TABLE 16

Regression Results for College Graduates

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0615 (10.97)	0.0732 (14.69)	0.0695 (15.52)
$EXPER_i^2$	-0.0009 (2.198)	-0.0010 (2.632)	-0.0004 (1.059)
$COHORT_{it}$	70.047 (1.946)	31.607 (2.648)	-6.7142 (1.961)
$EXPER_i*COHORT_{it}$	10.145 (3.031)	3.4194 (3.080)	2.0519 (5.220)
$POPW_{it}$	-2.0798 (5.681)	-1.4593 (3.890)	-0.2572 (1.664)
Buse R^2	0.8873	0.9534	0.9424
S.E.E.	0.9809	0.9569	0.9736
N	90	90	90

Note: The absolute values of t-statistics are in parentheses.

autocorrelations.[2] Furthermore, residuals are probably correlated across equations by firm size and schooling groups so that estimates should not be viewed as independent. A generalized least squares (GLS) procedure is used on the estimation of the earnings equations following the cross-sectionally heteroscedastic and time-wise autoregressive model discussed in Kmenta (1971, pp. 509-512)[3], ignoring the possibility of contemporaneous correlation across equations. As is always true in such cases, estimates may be unbiased but are inefficient, and so computed standard errors are biased.

The coefficients of experience ($EXPER_i$) are all positive and significantly different from zero at the 5 % significance level and the coefficients of experience squared ($EXPER_i^2$) are all negative. It means that concave earnings profiles are found in all regressions, and diminishing returns to experience prevail in production.

The main purpose of this study is to examine the changes in the magnitude of cohort size effects on earnings over the life cycle, by estimating the effects different for each level of experience. By partially differentiating the estimated equations in respect to $COHORT_{it}$, we have the following equation;

(5.1) $\partial \ln W_{it}/\partial COHORT_{it} = b_3 + b_4 EXPER_i$

The coefficient of b_3 represents the effect of unit change in cohort size of new entrants (those who have less than one year of experience) on the percentage change in their (own) earnings. It is negative under the assumption of imperfect substitution between new entrants and more experienced workers. On the other hand, the absolute size of b_4 represents the speed of decline or increase of depressed earnings at entry of large cohort into labor market for each positive or negative signs, respectively, as the entrants gain additional labor market experience.

The cohort size effects on earnings are significantly negative upon entry ($b_3 < 0$) except for high school graduates in small firms and college graduates in small and medium firms. On the other hand, the coefficients of experience-cohort size interaction terms ($EXPER_i * COHORT_{it}$) are all significantly positive.[4] Thus, the evidence generally suggests that even though large cohorts experience depressed earnings at the entry level, they experience faster rate of early career earnings growth and steeper earnings profiles than do smaller cohorts. This is consistent with Welch's (1979) but contrary to Berger's (1985) results in the case of the U.S. This finding suggests that when large cohorts enter the labor market, they face depressed earnings levels and low opportunity costs of investment activities. Therefore, they undertake larger amounts of investment than do individuals in small cohorts and experience faster rates of earnings growth in the early stages of the career, at least in Korea's labor market. Also, the structure of Korean industry had changed dramatically during the 1970s, which is the period of high growth in Korean economy. It seems reasonable that given changes in technology, firm-specific training would be provided to younger rather than older workers, i.e., the younger, larger cohorts during the 1970s had more chances to increase their human capital investments and productivities than older workers.

The coefficient of $COHORT_{it}$ of the high school graduates in small firms is positive but insignificant, and so it can not be rejected the null hypothesis that the coefficient is equal to zero. The regressions for college educated in small and medium firms have the significantly positive signs of $COHORT_{it}$, which are inconsistent with a priori expectations. One interpretation of this finding is that there is relatively strong complementarity between work activities performed at different phases of the career in professional and managerial capacities where the highly educated tend to be concentrated, especially in small and medium firms. The second possible explanation could be specification error in the earnings equation for the college graduates. For example, our earnings equations do not control for the qualitative changes in human capital embodied in different cohorts of the labor force. If the quality of a college education, which is one of the cohort components stated earlier, and post-college on-the-job training improved over time, there would be a positive correlation between qualitative changes in human capital and cohort size for the college groups. Therefore, an overestimated coefficient of the cohort size effect would be obtained.

The estimates of cohort size effects on earnings in terms of both $COHORT_{it}$ and $EXPER_i*COHORT_{it}$ have all expected signs and are significant for all education levels <u>in large firms</u>, for primary and middle, and high school graduates <u>in medium firms</u>, and only for primary and middle school graduates <u>in small firms</u>. In other words, the bigger the firm size, the more significant the effects of negative cohort size on earnings in all education levels. This is consistent with the idea that in large firms whose technology becomes more capital-intensive, the substitutability between junior and established workers is smallest, but in small firms whose technology becomes more labor-intensive, the substitutability is greatest. The negative cohort size effects exist with imperfect substitution between junior and established employees, with neither perfect substitution nor complementarity between them in a production.

One of the interesting findings is that the coefficients of $COHORT_{it}$ are decreased in absolute value with educational levels in small and medium firms, and increased with educational levels in large firms.[5] In other words, the biggest initial cohort size effect are estimated for college graduates in large firms, and for primary and middle school graduates in small and medium firms.

Another interesting finding is that the absolute size of the coefficients of experience-cohort size interaction decreases with firm size in all education levels, so negative cohort size effects decrease more rapidly in small firms than in large firms. This point would be interpreted in terms of the difference in specificity of training among three types of firm size. These findings of decreases in the absolute size of $EXPER_i$*$COHORT_{it}$ with firm size support the argument that the specificity of training increases with firm size. As has been discussed in Chapter III, capital intensity and market power are positively related to the specificity of training. Large firms are more likely to be capital-intensive and have strong market power than small firms. Training in large Korean firms is more specific than that in small firms, during the 1970s.

Using this logic, we can say the estimates are consistent with the view that substitutability between junior and established employees is greatest in small firms and smallest in large firms, because the career-phase model predicts that the coefficients are inversely proportional to junior-senior worker substitution elasticities (see equation (4.8) in Chapter IV). Thus, the finding of the effects of $EXPER_i*COHORT_{it}$ decreasing with firm size suggests that the negative cohort size effect decreases more rapidly in small firms than in large firms with worker's additional year of experience in current firms, and the substitutability between junior and established workers is smallest in large firms, which offer more firm-specific training and/or require more firm-specific human capital than small firms. Also, it is consistent with the idea that the absolute cost of training increases with increased specificity of training, and the rate of increase in earnings from the additional years of firm service should be lower in large firms than that in smaller firms. Thus, the new entrants of large cohorts employed in small firms catch up the level of earnings of "normal" cohorts more rapidly than those employed in larger firms.

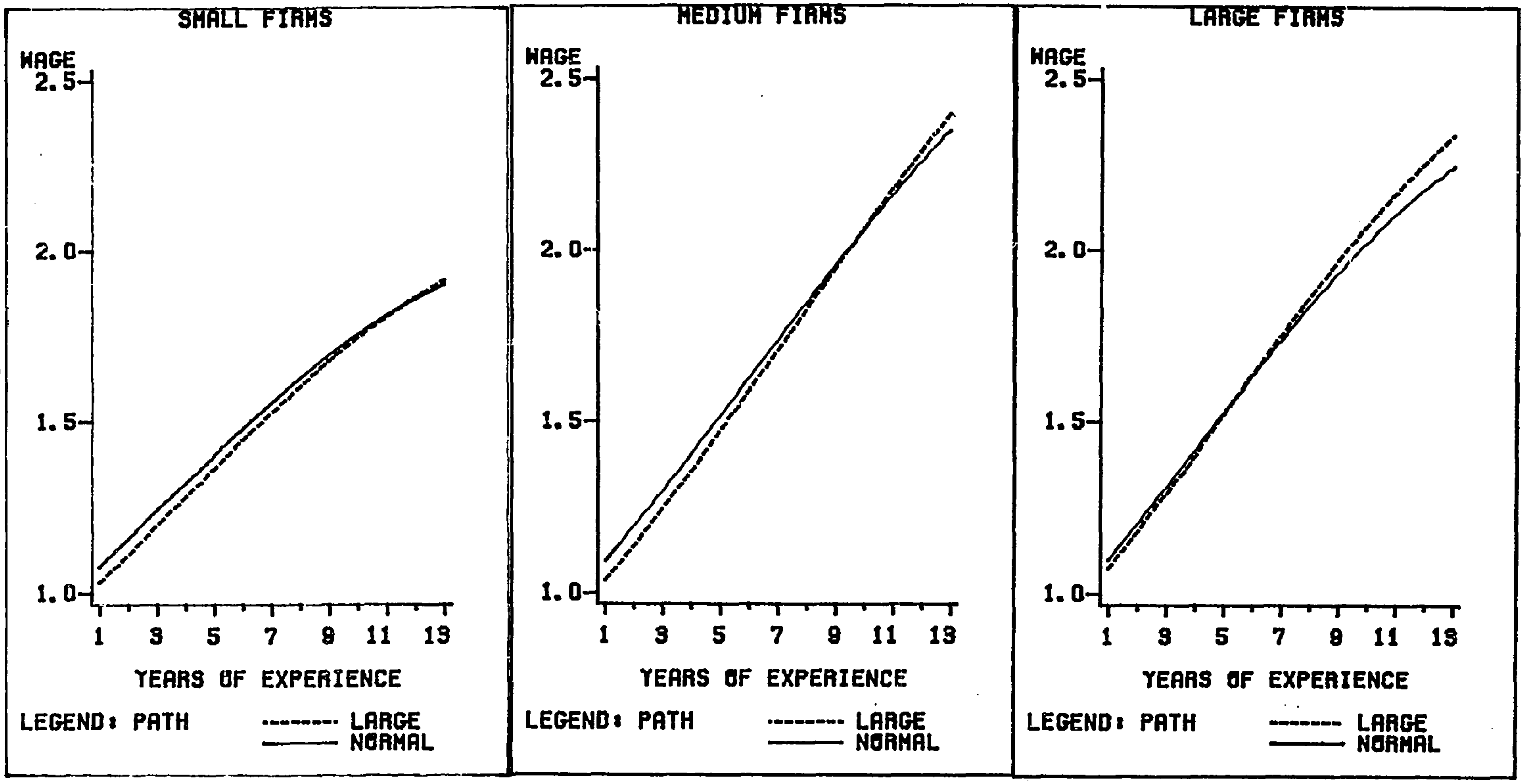
The coefficients of $POPW_{it}$ are significantly negative in all regressions except the case of medium firms for primary and middle school graduates. These results may suggest that there are significant differences in earnings between the two groups, production and non-production workers in favor of production workers only for primary and middle school graduates in medium firms, but in favor of non-production workers for all others. This result favoring non-production workers in terms of wages is consistent with the past research about wage differentials between them in Korea.

The profiles implied by the estimated equations are illustrated in Figure 5 only for the primary and middle school graduates, which have the expected and significant cohort size effects in all categories of firm size. The difference between the "normal" earnings profile and that for an unusually large cohort is significantly negative in the early stages of the career. There would, however, be a point, at which individuals in large cohorts become fully-vested workers and catch up to the level of the "normal" earnings (11.4, 9.9, and 5.4 years of experience for each firm size in this study) when the net cohort size effect on earnings becomes positive.

One possible interpretation of the positive effect is that there would be a positive correlation between the amounts of human capital accumulation and cohort size for the relatively older workers, and so the effect could be overestimated. As seen in the empirical results, individuals in larger cohorts tend to invest in greater amounts of human capital through training in the early stages of the career, implying the positive correlation between the amounts of human capital accumulation and cohort size as they age. We are, here, more interested in individuals' behavior during the early career experiences of the larger baby-boom cohorts. The estimates for older workers are less interesting since these individuals have already been fully absorbed into the labor force and have made any necessary

FIGURE 5

Empirical Contrast of Career Earnings Paths between Normal and Unusually Large Cohorts



Note: The values for the graphs are calculated by Wage = exp $(b_1 EXPER_i + b_2 EXPER_i^2 + b_3 \overline{COHORT}_{it} + b_4 EXPER_i * \overline{COHORT}_{it})$, using $b_3 = b_4 = 0$ for normal cohort and all estimated coefficients for large cohort.

adjustments in their human capital investments in response to cohort size.

FOOTNOTES

1. According to the survey report in 1978, the last year reporting the wages of primary and middle school graduates were separately, the ratios of total monthly male earnings for each schooling groups to the earnings for primary school graduates are as follows: primary, 100.0; middle, 106.1; high, 145.5; junior college, 205.4; and college graduates, 303.2.

2. Welch (1979) and Berger (1985) weighted the observations in their regression analyses by cell frequencies of earners to avoid the heteroscedasticity problems inherent in grouped data (see Maddala (1977), pp. 268-274.), ignoring the possibilities of autocorrelation and contemporaneous correlation across equations.

3. The particular characterization of the model estimated in this study is as follows:
Consider a two-variable model,

   (1) $Y_{it} = a + b\, X_{it} + e_{it},\quad i = 1, 2, \ldots, N \quad t = 1, 2, \ldots, T$

   where N is the number of cross-section units and T is the number of time periods. It is frequently assumed that the regression disturbances are mutually independent but heteroscedastic in cross-section, and autoregressive in time-series observations.

(heteroscedasticity)	$E(e_{it}^2) = \sigma_i^2$
(cross-sectionally independence)	$E(e_{it}\, e_{jt}) = 0 \quad (i \neq j)$
(autoregression)	$e_{it} = \rho_i e_{i,t-1} + u_{it}$

   where $u_{it} \sim N(0, \sigma_{ui}^2)$, $e_{it} \sim N(0, \sigma_{ui}^2/(1-\rho_i^2))$,
   and $E(e_{i,t-1}\, u_{jt}) = 0$ for all i, j.
   We assume that the parameter ρ has the same value for all cross-sectional units; i.e., $\rho_i = \rho_j = \rho$ for all i, j = 1, 2, ..,N. because the numbers of time periods are not enough to estimate ρ_i to vary from one cross-sectional unit to another.
   First, we apply the ordinary least squares (OLS) method to all N*T observations to estimate ρ and then use the estimated $\hat{\rho}$ as a basis for the generalized least squares (GLS) regressions.

   $$\hat{\rho} = \Sigma_i \Sigma_t\, e_{it}\, e_{i,t-1} / \Sigma_i \Sigma_t\, e_{i,t-1}^2$$

   where i = 1, 2, . ., N; t = 2, 3, . .,T.
   Next, we use the $\hat{\rho}$ to transform the observations of the original model:

   (2) $Y^*_{it} = a(1-\hat{\rho}) + b\, X^*_{it} + u^*_{it}$,

where $Y^*_{it} = Y_{it} - \hat{\rho}\, Y_{i,t-1}$, $X^*_{it} = X_{it} - \hat{\rho}\, X_{i,t-1}$, and $u^*_{it} = e_{it} - \hat{\rho}\, e_{i,t-1}$.
To this end, we apply the OLS to the generalized difference form of (2) for which we have N(T-1) observations.

Here, $\hat{\sigma}_{ui}^2 = (1/NT-K-1)\Sigma_i \Sigma_t u^{*2}_{it}$,

Since $\hat{\sigma}_{ui}^2 = \sigma_i^2(1-\rho^2)$, σ_i^2 can be estimated by $\hat{\sigma}_i^2 = \hat{\sigma}_{ui}^2/(1-\hat{\rho}^2)$. Since $\hat{\rho}$ is consistent of ρ, $\hat{\sigma}_i^2$ is a consistent estimator of σ_i^2.
Having obtained consistent estimators of ρ and σ_i^2, we can obtain the desired estimates of the regression coefficients and their variances in the GLS. The software for the model is available in the command "POOL" in SHAZAM.

4. The measure of $COHORT_{it}$ is arbitrary in terms of the five adjacent experience groups and their weights (see equation (4.13)). Thus, the alternative measure of the variable is calculated as follows:

$$COHORT'_{it} = \sum_{k=-1}^{1} w'_k (N_{i+k,t}/N_t),$$

where w'_k = (1/4, 2/4, 1/4).

The regression results with $COHORT'_{it}$ instead of $COHORT_{it}$ are reported in the Appendix. It is found that the results are almost the same and consistent with the empirical explanations about the results of the regression with $COHORT_{it}$.

5. From now on, I will exclude the small firms in the group of high school graduates, and the small and medium firms in the college graduates, which have the positive and unexpected cohort size effects, for the statements of results.

CHAPTER VI

CONCLUSIONS

A. Summary of Major Findings

Based on the human capital theory, changes in the age-experience profiles of male earnings in Korea have been analyzed with the data from 1972 to 1982. On the supply side, demographic changes -- specifically the entrance of the post-Korean War baby-boom cohorts into the labor market -- had a profound impact on earnings profiles, especially for those male workers who have not received college education. In discussing the firm size differences in demand for labor, the earnings equations are estimated by firm size and education level. It is argued that the substitutability between junior and senior workers is less in large firms than in smaller firms.

The empirical results presented here are generally consistent with the idea that the effects of cohort size on earnings would be negative and the effects of cohort size on earnings growth be indeterminate from a human capital perspective, but those effects should be different between large firms and smaller firms. Large firms offer more specificity of training and require more firm-specific human capital than smaller firms. The argument is that the substitutability between junior and senior workers is greater in small firms than in large firms whose technology becomes more capital-intensive, and the absolute cost of training increases with increased specificity of training.

It is found that while cohort size depresses earnings at entry, these negative effects of cohort size diminish and wages reach "normal" levels at relatively young ages, except for college graduates in small and medium-size firms. Thus, cohort size generally has a negative effect on earnings levels but a positive effect on early career earnings growth. This implies that the costs of human capital investments are reduced in larger cohorts and the expected returns to investments by larger cohorts are larger than those by small cohorts. Therefore, the individuals in larger cohorts tend to invest in greater amounts of human capital and experience faster rates of earnings growth in the early stages of the career. Moreover, the greatest positive effect on earnings growth is found in small firms for all education levels, which is consistent with the idea that the substitutability between younger and older, more experienced workers is the greatest in small firms, and the smallest in large firms, and so the negative cohort size effect of entry cohort diminishes more rapidly in small firms than in larger firms. Also, it is consistent with the idea that the cost of training as a human capital investment increases with increased specificity of training, which is more relevant in the case of large firms than smaller firms.

The regressions for the college graduates in small and medium firms indicate a positive effect of cohort size on earnings even in the early career phase. One interpretation of this finding is that there would be relatively strong complementarity between work activities performed at different phases of the career in professional and managerial capacities where the highly educated tend to be concentrated. The other possible interpretation is that there could be a specification error in the earnings equations estimated, which do not completely control for changes in the quality of schooling in different cohorts.

In summary, cohort size effects on earnings levels generally appear to decline with experience. In other words, the effects of large swings in demographic composition of the labor force on the structure of earnings may be temporary in nature.

B. Limitations of the Study and Suggestions for Further Research

This study is of interest in understanding the dynamics of age-experience profiles of earnings over time, emphasizing the supply side of labor within the demand side approach (human capital approach in my study). There still remain several possible avenues of further research. Even though the structural change in Korea's labor market, where there are firm size differences in specificity of training, wages, etc., is considered by estimating the earnings equations for each type of firm size, this study would hopefully stimulate further research about labor market segmentation in Korea.

A major portion of the analysis in this study deals with male workers, and more research needs to be done to sort out cohort size effects for female workers. This inquiry could possibly supplement ongoing research on female labor supply through the addition of cohort size variables.

The empirical results we have discussed so far do not take into account shifts in demand except insofar as narrow bands of entry cohort (15 years of experience) reflect this shift. In other words, the effect of gradual improvements in quality of education might influence the productivities and the demand for younger workers as opposed to older workers, and hence the relative earnings. Also, increases in capital might shift demand from younger towards older workers, which will give the earnings profile a steeper tilt, if skilled labor (or experienced workers) is relatively more complementary to capital than unskilled labor (or younger workers). The effects of changes in quality of schooling and in capital are partially considered only by estimating the earnings equations for relatively narrow bands of entry cohort in this study. Ideally it would be useful in this context to introduce some exogenous variables which would be proxies for demand shift. Unfortunately, the accomplishment of this task is not feasible with the data as well as the methodology used in this study. However, the failure to account for the demand shift indicates the need for the careful consideration of labor demand in future studies.

This study has assumed the formal education choice and sectorial (large, medium, and small firms) self-selection to be exogenous. However, there are probably demographic effects on the choice of level of education as training just like on-the-job training. Also, heterogeneity of workers in human capital productivities, and of firms in providing learning opportunities, implies that each worker is choosing a firm according to his comparative advantage in learning activity to maximize the present value of his life-time earnings stream by obtaining an optimal life-time accumulation path of human capital. An investigation of these effects should also be undertaken in future research.

APPENDIX

TABLE 17

Regression Results with Different COHORT Variables

(Primary and Middle School Graduates)

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0807 (9.691)	0.0987 (12.13)	0.1023 (16.36)
$EXPER_i^2$	-0.0024 (4.208)	-0.0024 (3.939)	-0.0031 (7.200)
$COHORT'_{it}$	-15.057 (2.598)	-6.4074 (2.119)	-1.0114 (1.875)
$EXPER_i*COHORT'_{it}$	1.3820 (2.500)	0.7512 (2.611)	0.2779 (2.751)
$POPW_{it}$	-0.2629 (2.273)	1.1797 (6.268)	-0.2751 (1.856)
Buse R^2	0.9414	0.9372	0.9578
S.E.E.	0.9628	0.9724	0.9696

Note: The absolute values of t-statistics are in parentheses.

TABLE 17 (continued)

Regression Results with Different COHORT Variables

(High School Graduates)

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0834 (25.84)	0.0836 (20.24)	0.0625 (10.51)
$EXPER_i^2$	-0.0027 (11.90)	-0.0021 (7.929)	-0.0013 (3.122)
$COHORT'_{it}$	0.6784 (0.104)	-6.2792 (2.396)	-4.0855 (4.131)
$EXPER_i$*$COHORT'_{it}$	0.8846 (1.518)	0.8789 (3.573)	0.1855 (1.834)
$POPW_{it}$	-0.6783 (9.486)	-0.1878 (1.942)	-0.5847 (5.506)
Buse R^2	0.9725	0.9609	0.9684
S.E.E.	0.3899	0.9615	0.9788

Note: The absolute values of t-statistics are in parentheses.

TABLE 17 (continued)

Regression Results with Different COHORT Variables

(College Graduates)

Explanatory Variables	Small Firms	Medium Firms	Large Firms
$EXPER_i$	0.0610 (11.66)	0.0697 (15.94)	0.0684 (16.38)
$EXPER_i^2$	-0.0012 (2.315)	-0.0007 (2.194)	-0.0004 (1.083)
$COHORT'_{it}$	54.186 (1.771)	21.323 (2.231)	-7.8792 (2.773)
$EXPER_i$*$COHORT'_{it}$	11.018 (3.807)	4.0311 (4.230)	2.0468 (5.957)
$POPW_{it}$	-2.1176 (5.953)	-1.4429 (4.043)	-0.2404 (1.578)
Buse R^2	0.8981	0.9623	0.9430
S.E.E.	0.9831	0.9577	0.9734

Note: The absolute values of t-statistics are in parentheses.

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