CHAPTER 2

Literature Review and Theoretical Foundation

2.1 Methodology Review

Muhammad Afzal, M. S. (2010) analyzed the relationship between school education and economic growth in Pakistan using the ARDL bounds testing approach to co-integration and investigated the short run and long run relationship between school education and economic growth using the annual time series data during 1970-1971 and 2008-2009. The variables used by the authors are the real GDP, real physical, poverty, inflation and general school enrollment ratio. This paper mentioned that the school enrollment rate and economic growth are the direct relationship both long run and short run. The authors found that there are the co-integration between the real GDP, poverty, inflation and school enrollment ratio when both the school enrollment ratio and real GDP are the dependent variables. The results of this paper are that the impact of physical capital is the positive and statically significant on the economic growth both the long-run and short-run relationship. Net school enrollment ratio and economic growth has a positive significant relationship not only in the long-run but also short-run. Inflation as the proxy of macroeconomic stability delayed the economic growth in the short-run and long-run. However, there is the negatively and significantly relationship between the school education only in the long-run.

Shahid, M. I. (May 2012) studied the causal relationship among the economic growth and human capital formation in Pakistan during 1972 to 2009. The author used GDP per capita as the proxy of economic development (dependent variable) and the human capital formation, physical capital and labor for as the independent variables. The methodology is the autoregressive distributed lag model (ARDL) bound testing approach to test long-run co-integration and the error correction model is used to test the

short-run. The author also used the Pair-wise Granger Causality test to check the causality between the variables. The results showed that the GDP per capita as the dependent variable and the human capital formation, investment in physical capital and the labor force have the long-run co-integration and these dependent variable and independent variables are the positively significant relationship. The Pair-wise Granger test showed that the economic development of Pakistan and the human capital formation have the bi-directional causality.

Gebrehiwot, K. G. (June 2013) examined the short run and long run relationship between the human capital and economic growth in Ethiopia using the autoregressive distributed lag model (ARDL) bound testing approach to co-integration and the error correction model during the period 1974-75 to 2010-2011. The dependent variable is the real GDP per capital as the proxy of economic growth and the independent variables are the secondary school enrollment rate as the education human capital, health expenditure as the percentage of GDP as the proxy of health human capital, the share of real gross fixed capital formation to GDP, the labor force, ratio of government expenditure to GDP (only domestic expenditure sources), the official development assistance(ODA) and the two dummy variables; one dummy is the economic policy changes and the other is either the good weather of drought. There are the long run co-integration between the economic growth and the explanatory variables which are the education human capital, health human capital, government expenditure as the percentage of GDP, share of gross fixed capital formation, ODA, labor force and the two dummy variables. The results are the education human capital, health human capital are the positively significant in the long run and these variables are the main contributor of economic growth in Ethiopia. The government expenditure as the percentage of GDP, ODA and the drought dummy variables are the significantly negative relationship. However the labor force, gross capital formation and the policy dummy variables are not significant. Finally the author used the Pair wise Granger Causality test using the lag length one and lag length two to check the causality between the economic growth, education human capital and health human capital. The granger causality results shows that health human capital and the real gross domestic product per capital has the uni-directional causality and there is the bi-directional causal relationship between the real GDP per capita and the education health human capital using the lag length one. But by increasing the lag length into two,

there is no significant causal relationship between the dependent variable, the education human capital and health human capital.

Monir Uddun Admed, M. M. (September 2013) analyzed the relationship between the consumer price index and the nominal wage rate during the 1975-2010. The author used the ARDL bound testing approach to analyze the long run and short run relationship between the price and the wage rate while including the macroeconomic factors which are price inflation, nominal exchange rate, domestic credit and real GDP product. The author used the FMOLS, DOLS and Johansen co-integration test however the result of these tests are robust for the short-run and long-run estimation. In addition to, the augmented Granger causality test between price and the macroeconomics variables. The dependent variable is consumer price index which is based on the 1995-96 and the independent variables are the domestic credit, real GDP and nominal exchange rate, and all of the variables are logarithmic form. According to the ARDL approach, the bound test is used whether there is long run co-integration or not between the variables, and the author used the five equations in order to analyze which equation is the best equation among five equations. After that, the short run and long run parameters are estimated. Among these five models, there is long run co-integration between the price as the dependent variable and the the domestic credit, real GDP and nominal exchange rate.

Zara Khan (2013) studied education and economic growth in Pakistan during the period of 1970-2011 using the ARDL approach. This paper mainly examined the two main objectives that are the different level of education impact on economic growth in Pakistan and determining the impact of effective labor on economic growth meaning that the investment in education is the important factor of economic growth. The results of this paper are as follows. The physical capital, labor, and university education are the positively significant on the country's output growth in the long-run. An increase in one percent of university education raises the economic growth by 0.14 %. Primary school enrollment rate and economic growth have positively relationship however this result is insignificant. Secondary school enrollment rate and the economic growth have the negative relationship and result is also insignificant. In the short-run, the relationship between the primary, secondary school enrollment rate, and the economic growth has

the insignificantly negative relationship. However, universal education is positively related to the economic growth, and physical capital stock is also highly significant. Secondary school enrollment rate and the labor negatively contributes to the economic growth.

2.2 School Enrolment and Macroeconomic Determinants Review

There are many researchers who study about the relationship between the education and macroeconomic factors like gross domestic product, economic stability, political stability, foreign direct investment, exports and imports, etc. Many economists used a lot of different data, different proxy and different ways of test to interpret the role of education in the economy.

Deolalikar, A. B. (January 1997) studied about the relationship of the primary school enrollment and school expenditures per pupil between the aged 7-14 years using secondary survey data from Kenya. The author used the school enrollment rate as the dependent variable which is dichotomous variable means that the value one was the school enrollment for child and the alternative was zero and the explanatory variables are the household characteristics that are the age and education of family head, numbers of siblings, urban/ rural population, water sources as the opportunity cost of time, the age and characteristics of spouse. The author used the two variables for the schooling which are the number of primary school teachers per 1,000 children and the other is the teacher-pupil ratio. The results of logit model using the teacher-pupil ratio as one of the explanatory variables are that the number of younger siblings are negatively relationship to the primary school enrollment, both the age and education of spouse are positively significant to the primary school enrollment and also the education of household head is the positively relationship. And the other important explanatory variable, water collection is the negatively significant to the primary school enrollment. The teacher-pupil ratio as the most important explanatory variable is the opposite effects on the primary school enrollment rate because the cost of the increasing teacher-pupil ratio is one of the schooling expenses and it can lead to the negative effect on the primary school enrollment rate for the poor children.

P.Connolly, M. (June 14, 2001) studied about the impact of human capital on the economic growth in the United States after the period 1880. In this paper, the author used the real income per worker in each state as the dependent variable and the formal education as the human capital, capital stock per worker and the workforce are the independent variables during the period 1880 to 1920. All of the variables are transformed to the logarithmic form and used the OLS regression, fixed effect model and random effect model. The OLS regression showed that there is the positively significant relationship between the real income per worker and all of the explanatory variables. And the author used the two dependent variables which are the real income per worker and the growth rate of real income for the fixed effect model regression. In the fixed effect model, the human capital stock per worker, physical stock per worker and labor force are the positively significant with the real income per worker and all of the explanatory variables are insignificant relationship with the growth rate of real income. In the random effects estimation, the human capital stock per worker, capital stock per worker, the workforce and the real income per worker have the positive significantly relationship and only the human capital stock is the negative relationship with the growth rate of real income.

St.Aubyn, A. A. (2004) analyzed that the relationship between the educational attainment and the education expenditure in the OECD countries using the Tobit, single and the double bootstrap regression methods. The dependent variable is the PISA results as the proxy of educational attainment in 2003 and the independent variables are teachers per 100 students (2000-02), hours per year in school (2000-02) parent education attainment (2001-02) and GDP per capita, PPP USD (2003).

Shama, M. U. (2008) analyzed the relationship between the primary school enrollment decision and the family characteristics of the district Lahore. The author used the primary data which are collected from the 2520 households from the urban area and the 800 households from the rural area. The authors used both the OLS estimation and logit models. The authors collected the characterizes of families which are the proportions of primary enrolled children aged 5-9 years, family size, per capita income of the households, the years of schooling of the households, dwelling ownership, dependency ratio of the family members, access to school, literacy ratio, per capita

consumption and education expenditure of the families. The authors assumed that the dependent variable is the dummy variable; 1 means that the one of the children is enrolled at the primary school level and 0 means that none of the children is enrolled at the primary school level. In the OLS regression, the results are the positively relationship between the gross enrollment rate as the dependent variable and the years of schooling of the head of households, family size, dwelling ownership and dependency ratio. In the logit model, the years of schooling of the households are insignificantly relationship to the gross enrollment rate in contract to the OLS regression and the other explanatory variables which are the family size, dwelling ownership, education expenses and the dependency ratio are the positively significant relationship to the gross enrollment rate. When the author used the net school enrollment rate as another dependent variable, there are strongly positive and significant relationship between the net school enrollment rate and the explanatory variables which are the family size, dwelling ownership, expenditure of the household education, literacy ratio and the dependency ratio in both OLS estimation and the logit model.

V.Cooray, A. (2009), author examined the impact of educational quantity and quality on economic growth in 46 developing countries including low and middle income countries using the GMM estimator and OLS estimator during the period 1996-2005. The dependent variable is the GDP per capita as the proxy of economic growth and the independent variables are share of investment to GDP, population growth rate, ,primary enrollment ratio, secondary enrollment ratio, tertiary enrollment ratio, primary repetition rate, secondary repetition rate, education expenditure as percentage of GDP, public expenditure per primary student as a percentage of GDP per capita, public expenditure per secondary student as a percentage of GDP per capita, survival rate to grade 5, primary pupil-teacher ratio, secondary pupil-teacher ratio, schooling life expectancy, trained teachers in primary, employment to population ratio. The author analyzed the four classified model; (1) education quantity and growth outcomes, (2) School enrollment, education quality and growth outcomes, (3) educational spending, educational quality and growth outcomes, (4) educational spending per student, educational quality and growth outcomes. The results of education quantity and growth are the positively relationship between the physical capital, primary school enrollment rate, secondary school enrollment rate, tertiary school enrollment rate, government

expenditure per student in primary education, government expenditure per student in secondary education, government expenditure per student in tertiary education and the gross domestic per capita. The results of the second model which is the school enrollment, education quality and growth outcomes are the strong positively relationship between the physical capital, primary school enrollment rate, secondary school enrollment rate and tertiary school enrollment rate and the growth outcomes. The only survival rate as the proxy of education quality is the positively statistically significant and the other education quality variables are insignificant. The results of the education spending, education quality and growth outcomes are the positively relationship between the physical capital, survival rate, primary repetition rate, primary pupil-teacher ratio, schooling life expectancy, trained teachers in primary school, the test score and the GDP per capita as the dependent variables. And the final model which examined the relationship between the educational spending per student, educational quality and growth outcomes showed that the positively relationship between the physical capital, government expenditure per student in primary education, government expenditure per student in secondary education, survival rate, primary repetition rate, primary pupil teacher ratio, secondary pupil teacher ratio, schooling life expectancy, trained teachers, test score with the GDP per capita.

Dauda, R. O. (2011) focused on the effect of macroeconomics variables like the government educational expenditure and the macroeconomics uncertainty on the educational schooling outcomes in Nigeria. The author used the Johansen co-integration test and error correction model to check the long-run and short-run relationship of the dependent variable and the independent variables between the time periods 1970-2007. The dependent variable is the adult literacy rate as the proxy of educational attainment and the independent variables are government expenditure as the percent of GDP, annual change of inflation rate as the proxy of macroeconomic uncertainty, GDP per capita measured in PPP and urban population. The Johansen co-integration test showed that the GDP per capita income is positively relationship to the educational attainment but not significant. However, urbanization and education expenditure as the percentage of GDP are positively significant relationship to the adult literacy rate and the inflation rate as the macroeconomic uncertainty is negatively significant.

Mr.Furrukh Bashir, M. N. (October 2011) examined that the effect of macroeconomics variables on the various educational level enrollment which are the primary school enrollment, secondary school enrollment, higher school level, college level, professional level and the university enrollment in Pakistan. The macroeconomics variables used in the model are the consumer price index, government revenue, employed labor force, government expenditure and health expenditure during the period 1972 to 2010. The author used the Johansen co-integration method for the long-run and the error correction model for the short run. The results of Johansen co-integration model are that the consumer price index and the inflation rate are adverse relationship to the primary, secondary, higher, college, professional and university enrollment rates. The relationship of the employed labor force and primary, secondary, higher, college, professional and university enrollment is the positively significant. And also the government expenditure and the health expenditure are positively relationship to the various educational enrollment rates. In constrast, the government revenue which is the important factors of macroeconomics variables is negatively significant to the educational attainment.

Liana Son, G. G. (2013) studied about the importance of education that can increase the economic growth for the five groups of EU members using the panel time series data which are analyzed the random, fixed effect and dynamic models. The author used the two educational human capital variables which are the years of schooling as the proxy of quantitative educational variable and the scores, skill tests as the proxy of qualitative educational variables. The dependent variable is the GDP per capita and the explanatory variables are the physical capital, the average years of schooling for all level of education, the quality of education, the degree of openness, life expectancy rate and the inflation rate. The model showed that the qualitative and quantitative human capital variables are positively significant to the GDP per capita and also the other explanatory variables like physical capital and life expectancy are positively relationship to the GDP per capita. The dynamics models which are the Generalized Least Squares Method (GLS) and Maximum Likelihood Estimator (MLE) are including the overtime differences for the dependent variable and explanatory variables. The results of dynamics model showed that the positively relationship between the GDP per capita and the explanatory varibles which are the qualitative human capital, physical

capital, degree of openness and life expectancy but only the quantities human have negatively relationship to the GDP per capita and statistically insignificant.

Emmanuel Carsamer, E. E. (July 2015) investigated the effect of government expenditure on primary and secondary school level using 20 developing countries in Africa area during the time period 1998-2012. The author used Kao panel co-integration test and time effect model and the dependent variables are the primary and secondary school enrollment rate and the key explanatory variables are the public educational expenditure, real GDP as a proxy of economic size, population, urbanization, GDP per capita as a proxy of standard living, number of teachers and the dummy variables using for the political stability and educational reforms. The results of Kao(1999) panel co-integration test show that the primary school enrollment and secondary school enrollment rate as the dependent variables have the long-run co-integration relationship to all of the explanatory variables. The results of the time effect model are the positively relationship between the educational expenditure and the primary school enrollment rate, secondary school enrollment rate with the GDP per capita as the control variable. When the GDP per capita are included to the model, the relationship of the primary school enrollment, the secondary school enrollment and the education expenditure as one of the explanatory variables are insignificant. This is because the education expenditure and the GDP per capita have the endoginity problem.

2.3 Theories

2.3.1 The Solow Model Augmented by Human-Capital

Mankiw, Romer, and Weil (1992) introduced the extension of the Solow model to include human capital as one of the inputs and included the separate factor into the Cobb-Douglas production function with Harrod-Domhar technological progress. The formal equation of Solow neo-classical growth model is:

$$Y_t = K_t^{\alpha} \, (AL_t)^{1-\alpha} \tag{2.1}$$

Where,

Y = output,

K = the stock of capital,

L = labor force,

A = the productivity of labor, which grows the exogenous rate

α = the elasticity of output with respect to capital

t = time

According to the Solow Neo-classical growth model, it allows the substitution of capital and labor and assumes that the capital and the labor have diminishing returns to the use of these inputs.

Assume that the original aggregate production function is constant returns to scale $Y = F(K, L)$. The output will be increased the same amount if all inputs are increased at same mount because of the constant return to scale.

The Solow model augmented by human capital is:

$$Y_t = K_t^{\alpha} H_t^{\beta} (AL)_t^{1-\alpha-\beta} \quad (2.2)$$

Where,

Y = output

K = capital

H = the stock of human capital

A = technology diffusion

L = labor

α, β and (1-α-β) = the parameter of the output with respect to the inputs.

This augmented Solow model assume that α+β<1 and there are the constant return to scale and diminishing returns to scale in the use of the input factors. Although the population and the technology diffusion increase the exogenous growth rates (n and g) respectively, capital had depreciated at the rate δ.

The augmented exogenous growth model called the human-capital augmented Solow model has three important assumptions. First, people invest in both human capital and physical capital and people invest a fraction of their income which

means people must choose their investments in the accumulation of human capital as a fraction of their income (SH), or their investments in the physical capital as a fraction of their income (SK). Second, human capital also depreciates at the constant rate δ like the physical capital. And the third assumption is that the final output can be applied for the consumption or investment in not only human capital but also physical capital.

By transforming the equation 2,

$$y^* = k_t^{\alpha} h_t^{\beta} \tag{2.3}$$

Where, $y^* = {}^{Y}/_{AL}$, $k = {}^{K}/_{AL}$, $h = {}^{H}/_{AL}$

According to this equation, A is the level of technology and this is constant. According to the above assumptions, the physical capital and the human capital per effective worker are shown as:

$$k^* = s_K y_t^* - (n + g + \delta)k_t^* = s_K k_t^{\alpha} h_t^{\beta} - (n + g + \delta)k_t \tag{2.4}$$

$$h^* = s_H y_t^* - (n + g + \delta)h_t^* = s_H k_t^{\alpha} h_t^{\beta} - (n + g + \delta)h_t \tag{2.5}$$

k^* and h^* denote the level of physical capital and the human capital per worker when the condition of the economy is the steady state condition, respectively. That steady state condition is stable and the two k^* and h* tend to be zero. The new transforming equation is:

$$k^* = \left[\frac{s_K^{1-\beta} s_H^{\beta}}{n+g+\delta}\right]^{1/1-\alpha-\beta} \tag{2.6}$$

Transforming the natural logarithm form,

$$lnk_t^* = \frac{1-\beta}{1-\alpha-\beta} lns_k + \frac{\beta}{1-\alpha-\beta} lns_h - \frac{1}{1-\alpha-\beta} \ln(n + g + \delta) \tag{2.7}$$

$$h^* = \left[\frac{s_K^{\alpha} s_H^{1-\alpha}}{n+g+\delta}\right]^{1/1-\alpha-\beta} \tag{2.8}$$

$$lnh_t^* = \frac{1-\alpha}{1-\alpha-\beta} lns_k + \frac{\beta}{1-\alpha-\beta} lns_h - \frac{1}{1-\alpha-\beta} \ln(n+g+\delta) \quad (2.9)$$

These two equations are substituted in the original production function, the steady state output (y_t^*):

$$lny_t^* = lnA_t + g_t + \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta} \ln s_k + \frac{\beta}{1-\alpha-\beta} \quad (2.10)$$

$lnA_t \; and \; g_t$ are not observable and so they are assumed to be the constant term (Mankiw, Romer and Weil, 1992; Bassanini and Scarpetta, 2001). The equation can be transformed as:

$$lny_t^* = C + \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta} \ln s_k + \frac{\beta}{1-\alpha-\beta} \ln s_h \quad (2.11)$$

According to the assumption of the diminishing returns to human capital and physical capital and all the quantities are constant in the steady state condition, the output per worker and capital per worker grow at the same rate of technological progress g. Although the investment in human capital has no effect on the long run growth of the economy, this investment has the level effect. The level effect of the economy is described by the equation (6). The relationship between the level of income per capital and the investment in human capital and physical capital is the positive relationship. However relationship between the level of income per capital and the rate of population growth is negative. This means that 10% increase investment in human capital and physical capital can cause 10% increase in the level of the income per capital. Therefore, people invest the fraction of their income in the investment in human capital or in physical capital leading to upwards steady state income level and higher long-run economic growth.

2.3.2 Endogenous Growth Models

There are two important approaches that the augmented human capital is incorporating in the growth models. These two important approaches are incorporating the accumulation of human capital as the engine of growth and the other approach is

that human capital is the stock of human capital as the incorporating in the innovation and adoption of technology diffusion.

(1) Growth with human capital accumulation

The original Solow model is augmented by the accumulation of human capital as the labor accumulation which similar to introducing the technology diffusion into the growth model. There are two control variables, consumption and the allocating the time between working and getting the needed skills, that means to allocate the working time and the training time (or education). The consumption variable affects the physical capital and the second variable (allocation of time) determines the future productivity. Growth model with human capital accumulation formulated by Lucas showed that the human capital is one of the important factors determining the long-run growth (need citation). According to Lucas, the production function is formulated as:

$$Y_t = AK_t^{\beta}(u_t h_t L_t)^{1-\beta} h_{a,t}^{\gamma} \tag{2.12}$$

Where,

Y is output

A is technology

L is labor

K is capital

u is fraction of individual's time allocation in working

h is the skill human capital

ha is the average human capital.

In this model, the technology diffusion is constant and the rate of population is the exogenous growth rate, g. There is the most important assumption in the Lucas model which concerns about the human capital that evolves over time. Lucas augmented that the accumulation of human capital is needed to consider the effort 1-ut and there is the relationship between the accumulation of human capital and the rate of change (ht). The Lucas assumption function is:

$$h^* = h_t \delta(1 - u_t) \tag{2.13}$$

$$\frac{h_t^*}{h_t} = \delta(1 - u_t) \tag{2.14}$$

The parameter δ determines the attainable output growth rate h which increases the productivity of skilled human capital from schooling. In the linearity assumption, it is assumed that there is effect on the growth rate of the human capital which means that the growth rate of the productivity is in the same percentage increase at the given rate the human capital is accumulated. However, Lucas stated that the human capital has no diminishing returns to scale and the accumulation human capital grows without bound, thus, leading to endogenous growth. The steady state condition of the Lucas model is mostly dependent on the external effects of human capital that is if $\gamma \neq 0$. The coefficient of the parameter $h_{a,t}^{\gamma}$ determines output. This model indicates that the higher benefits of the human capital accumulation are leading to spread over the whole population.

The steady-state condition of the Lucas model is the same growth rate of the output, physical and human capital if the effect of externalities is no effect on the economy ($\gamma = 0$). This condition is known as the so-called balanced growth path. In that case, if there is the positive external effect ($\gamma > 0$), the elasticity of the physical capital per worker will be higher than the human capital per worker (h). If the externalities are present in the model, this equilibrium condition can be called suboptimal growth that thus needs the government intervention in the economy.

(2) Endogenous Growth Model with the Changes of Human Capital and Technology

The second approach of the endogenous growth model is the accumulation of the technology progress into the Solow model. Nelson and Phelps's ideas were the first argument for the concept that the higher level of human capital would be more skillful to accept the new technologies (Schutt, 2003). And Romer was the author of the adoption of human capital and technologies, which are the other two important factors of economic growth. Romer augmented that there were three sectors

in the economy: a final-goods sector, an intermediate goods sector, and a research sector. He assumed that the existing human capital and stock of knowledge are used to invent the new design for products in the research sector and those new products are sold to the intermediate-goods sector. And then the combination the human capital and the existing stock of knowledge produces the final output which utilized the new designs. The production of the final output is formed:

$$Y = H_Y^{\alpha} L^{\beta} \sum_{i=1}^{A} x_i^{1-\alpha-\beta} \tag{2.15}$$

Where,

Y is output

L is labor

H_y is human capital

A is the stock of knowledge

x_i is intermediate inputs used in the final output production.

According to the above equation, the stocks of knowledge can determine the different amount of intermediate capital inputs. In the Romer's model, there are some important assumptions such that both the labor supply (L) and the total stock of human capital (H) are constant over time. The other assumption states that knowledge is non-rival input. Romer also argued contribution of the knowledge as non-rival inputs that lead to the increasing returns to scale and long-run economic growth. However, he pointed out that the stock of knowledge is the most useful in the research sector in the monopolistic competition because the perfect competition would not undertake the research sector. And the other important fact of the knowledge is that the stock of the knowledge influences the new ideas of the product designs. Romer's knowledge equation is:

$$A^{*} = \delta H_A A \tag{2.16}$$

$$\frac{A^{*}}{A} = \delta H_A \tag{2.17}$$

H_A is human capital employed in the research and the parameter δ measured the productivity of the research. The Augmented Solow model stated that the existing knowledge can create the new knowledge skills and new products. Romer pointed out two important facts in this model. The first is the knowledge and ideas of the human capital extents the variety of the new products and the second is that there is the knowledge spillover effects that can be considered the positive externalities not only in the economy but also in the society. The linearity equation pointed out that knowledge-skilled human capital in the research will lead to an improvement in the productivity of the human capital with the ratio of A. Romer cited that the increasing of the stock of human capital will lead to permanently increase the economic growth.

2.3.3 Human Capital theory

Human Capital can be defined as the stock of knowledge and the ability of the workers that contribute to the productivity. There are many different points of views for the human capital. Becker pointed out the human capital is one of the main contributors for the production process. The human capital with training and education increases the various tasks of the production process and increases the ability of the labors. Moreover, Becker stated that the human capital is the knowledge and skills (h) that is the directly contributor of the production function. The Gardener stated that there are different kinds of skills, personalities and abilities of human beings. Gardener discussed that not only physical abilities but also mental abilities, each individual has many dimensions regards to these abilities whether they are skillful or not. Schultz/Nelson-Phelps analyzed that the human capital has the ability to response and take action even if the immediate conditions occurred like the environmental changing. Bowles-Ginti's pointed out that there are the organizational skills to improve the ability and the skills to obey the orders which leads to co-operative skills, creative thinking and management.

(1) Human Capital Investments and The Separation Theorem

The Separation Theorem emphasized the decision of the individual investment of the human capital. The author considered the decision of the schooling for

individual human capital, so that schooling is the prices for the individual human capital like the commodity markets. The author assumed that the human capital markets is also the perfect capital markets, therefore the individual human being tried to get the maximization utility from schooling, and the discounted value of the schooling will also try to maximize. According to the assumption of the neoclassical growth theory, there has limitation on utility function $u(c)$ in all of human beings. Many assumptions of the instantaneous utility are limited and increase to a certain point, then becomes concave utility function. Moreover, the individual has the planning for the future T where T is allowed to infinity, future discount rate ρ>0 and constant death flow rate $\rho \geq 0$, so the maximize utility function for schooling is

$$max = \int_0^{\partial} \exp(-(\rho + \sigma)t)\, u\big(c(t)\big)dt \tag{2.18}$$

They supposed that individuals have the initial human capital $h(0) \geq 0$ since they are born and they considered the time trend, the human capital equation is

$$h(t) = G(t, h(t), s(t)) \tag{2.19}$$

$s(t) \in (0,1)$ is the fraction of time for the investment in schooling and the right hand side of the equation means that the human capital investment has many limitations and each individual decides how much of time is used for schooling to improve the human capital.

Every human being has the condition whether the limited time is used to invest in schooling or to work for earnings. The wage formula of the labor with the limited time was

$$W(t) = w(t)[1 - s(t)][h(t) + w(t)] \tag{2.20}$$

$1 - s(t)$ is one part of limited time for working in the labor market, and there is no leisure time. The link equation for the budget constraints and the labor earnings is

$$\int_0^T \exp(-rt)\, c(t)dt \leq \int_0^T \exp(-rt)\, w(t)[1 - s(t)][h(t) + w(t)]dt \tag{2.21}$$

r denotes that the constant interest rate on the his savings and borrowing for the time periods.

(2) Schooling Investments and Returns to Education

The Separation Theory stated that each human being has the trade-off between the schooling and the working for the earnings based on the limited time, so that the individual has the partial time for the human capital investment,

$$h(S) = \varphi(S) \tag{2.22}$$

According to the Separation Theory, $\varphi(S)$ is limited increasing and the concave function. However, the human capital increase over time as per of the differential equation of $\in [S, \infty]$. The growth equation for the human capital,

$$h(t) = g_h(t) \tag{2.23}$$

If $g_h \geq 0$, the wage equation for the human being is

$$w(t) = g_w\, w(f), \tag{2.24}$$

$$g_w + g_h < r + v \tag{2.25}$$

These two equation can be substituted to the maximize utility function for the schooling, then

$$max_S = \frac{\varphi(S)w(0)\exp\,(-(r+v-g_w)S)}{r+v-g_h-g_w} \tag{2.26}$$

Transforming the equation by the first difference,

$$\frac{\partial'(S^*)}{\partial(S^*)} = r + v - g_w \tag{2.27}$$

This equation showed that the higher value r and v increase the other investment instead of the human capital investment. After that the equation is integrated by S, the equation can be transformed

$$ln\partial(S^*) = constant + (r + v - g_w)S^* \tag{2.28}$$

Suppose the $\tau \geq S$, τ denotes the wage level of the worker's age with time.

$$W(S^*, t) = \exp(g_w t) \exp(g_h (t - S)) \partial(S) \quad (2.29)$$

Transforming to the log equation form,

$$\ln W(S^*, t) = (constant + (r + v - g_w) S^* + g_w t + g_n (t - S^*) \quad (2.30)$$

$(t - S^*)$ expressed as the experience of the individual after schooling, and $g_w t$ denoted that the time trend.

The wage earnings including the schooling and the experience,

$$lnW_j = constant + r_s S_j + r_e experience \quad (2.31)$$

j refers to the different level of schooling for individuals, and it stated that the tradeoff between the schooling and earnings. If individual study one more year for schooling, he give up the earnings for one more year. This means that the benefits of schooling directly proportional to the wage level with the rate $r + v - g_w$. However, the value of $r + v - g_w$ is between the 0.01 and 0.02 according to the empirical results.

(3) Schooling and Parental income

Schooling for children depends on the different family backgrounds and the other factors. The effect of parental income and schooling for the children

$$schooling = constant + \alpha . \log parental\ income \quad (2.32)$$

The relationship between the schooling for the children and family background is the positive relationship. Schooling for the children can be considered as consumption good. Therefore the more income of the parents can enroll to their children than the less income of the parents. Moreover, the background of the family impact on the quality than the quantity of the children's education because the higher income level of the family can invest longer than the others. Therefore, the education level of the children from the higher family income is higher. However, the education level of the

parents is also the contributors of the children's education. The author stated that the parent's education can affect the children's education than the income level of the parents. Moreover, the schooling quality, the other determinants like the government education expenditure and the condition of the country's economy can effect to the children's educational attainment.