Education and Poverty in Special Province of Yogyakarta: The Approach of Solow Growth Technology Model in Production Theory

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Abstract: From the economic aspect, the level of education is believed to reduce poverty by improving skills that can influence the household income. Meantime, the poor with skills produced from formal and non-formal education will be rescued from market price shocks. By using the perspective of the production function with adopts Solow's growth model technology, this study analyses how the formal and non-formal educations affect income levels, and subsequently consumption. With certain lines of consumption, a household is classified as poor or not poor so that it can be examined the probability of household being either poor or non-poor influenced by formal and non-formal education. This research is applied on Special Province of Yogyakarta and is expected to explain one aspect of poverty behaviour in Special Province of Yogyakarta.

1 INTRODUCTION

Poverty is a development effort to create prosperity through the fulfilment of human needs. Failure to meet basic needs can occur due to a market and requires the government's side to overcome it. According to Word Bank (2001), poverty is the understanding, or inability to achieve, a generally accepted standard of living.

In 2012 the Special Province of Yogyakarta experienced the worst level of poverty in the bottom 25 of 33 provinces) but has a very good Human Development Index (HDI). An interesting finding in D.I.Yogyakarta Province shows that high HDI is not followed by low poverty rates.

Good HDI will impact productive communities and subsequently depends on economic growth and declining unemployment. The improvement of HDI will be followed by economic growth and declining unemployment rate. HDI can encourage the improvement of human resources and in turn, will result in economic growth and decline in unemployment.

Improving the quality of human resources can occur with cheap investment educators. The impact of education on poverty is examined by (Grimm, 2005), found to be a direct effect of education and income, depending on the choice of employment and household composition. Education is an efficient way to reduce poverty and fairer inequality

The cause of someone being poor is an interesting study to observe. According to Barnes (2005), the globalisation resulted in industrialisation shifting from manufacturing industry to service industry, and there was a reduction of manpower with low human resources replaced by high human resource workforce. Barnes (2005) sees that the main factor causing poverty is the depletion of human resources of the poor.

The solution to poverty reduction is done by increasing the human resources of the poor. Investment in education will affect the ability of the poor to earn income. Rising incomes will reduce the number of poor families. Bhaumik and Banik (2009) found that human capital improvements are strongly related to the resilience of the poor to obtain permanent income. Increasing formal education to the poor will improve skills and sensitivity to external changes. This sensitivity will avoid the loss of their income. Poor people with more intensive formal

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skills will be spared from the failure of price-level shocks in the output market.

Theoretically, poverty is influenced by low productivity. A person's productivity level can be influenced by the level of education, real knowledge and skills and the level of health. The higher education that is graduated and the longer they go to education will have better skills and will have an impact on higher incomes and have a lower chance of becoming poor.

1.1 Solow Growth Model

It is assumed that the family is the smallest unit of production of goods and services by using its production factor in the form of capital and labour. Capital consists of human capital and physical capital.

The main assumptions of Solow's growth model are; (I) the economy is closed for international transactions, (ii) all stored output is invested, (iv) perfect price flexibility and monetary neutrality (i) the economy consists of one sector producing one type of commodity that can be used for either investment or consumption purposes; Apply and the economy always generates its potential output; (V) the rate of technological progress, population growth, and the rate of capital depreciation are all exogenously determined.

Solow growth model is built based on two big ideas namely production function and the equation of model accumulation function. The production function is assumed to follow the Cobb-Douglas production function as follows (C. Jones, 1998), (Romer, 2000), and the production function is based on physical capital (K), Productivity Augmented Labor (AL) and human capital (Jones) 1986):

$$Y = F(K, H, AL) = K_t^{\alpha} H_t^{\beta} A_t L_t^{1-\alpha-\beta} \quad (1)$$

α is worth between 0 and 1

$$h_t = (he_t), (e_t) > 0 \quad (2)$$

1.2 The Impact of Education on Labor Productivity

Education is one of the most important inputs to produce human resources. Education produces a stock of accumulated skills and experiences that make workers more productive, (Bassetti, 2012). Trostel (2004) suggests that the production function of human capital increases at a low level of education and declines at a high level of education. Trostel (2004) concluded that the educational relationship with labour productivity is non-linear and directly related to the accumulation of human capital. In other words, the production function of human capital has a cubic form, which is a typical production function used in the function of microeconomic production.

(Bassetti, 2008) States that education is the only input that increases human capital. Education deals with one's technological development capabilities. Education will enable one to capture new technologies and develop technology that will ultimately increase production through increased productivity (B. F. Jones, 2014). The process of the occurrence of human capital depends on the time in which the individual provides time for education. If Lt is the population at time t in an economy, μ is the time the individual chooses to work; it is the willingness of the individual at time t who is willing to invest his or her opinion for education. So the model of individuals willing to invest in education is:

Solow's growth model emphasises the importance of individual technology development from self-development because of the stock of knowledge. Knowledge stocks can occur from a person's education. The advent of technology will result in the depreciation of human capital stocks, because the new technology will require new knowledge to master the technology and will replace the old knowledge possessed by someone. High technology requires new knowledge and will leave the old knowledge known as the effects of vice (vintage effect). Technological advances affect the improvement of knowledge and will increase the demand for experts resulting in obsolete experts; the ultimate impact will increase the demand for individual education, known as the technical depreciation effect (Bassetti, 2008).

If Eht is the effect that an individual obtains because of the education obtained at time t, and t is the depreciation of human capital due to the effects of obsolescence at time t, then the model of human capital accumulation through education is:

$$\frac{dh_t}{de_t} = Eh_t - \theta(h_t) \quad (3)$$
$$\theta'(h_t) > 0$$

The Meaning of Equation (3) is the effect of individual educational investments on individual stocks of capital determined by individual productivity be-cause of education reduced by depreciation due to the effects of knowledge obsolescence.

By combining two equations (2) and (3) then it is assumed that the stock of human capital is linearly correlated with the depreciation of knowledge then obtained:

$$\frac{dh_t}{de_t} = Ehe_t - \sigma h(e_t) \quad (4)$$

It is assumed that the productivity gained from the educational investment will outweigh the effects of obsolescence (E> σ) so that educational investment affects the accumulation of individual knowledge. The process of knowledge accumulation can be written as follows:

$$h_t = \frac{E\exp(Ee_t)}{E-\sigma+\sigma\exp(Ee_t)} \quad (5)$$

Equation (5) means that the stock of knowledge accumulation will depend on the individual choice of the school and the knowledge stock is not proportional to the time of the education.

His process of obtaining knowledge stock is the aggregate sum of the individual activities in conducting educational activities, so the equation of accumulated knowledge stock is:

$$A = \int_0^L hi, di = L\bar{h} \quad (6)$$

Hi is the level of human capital owned by individuals in period t, and is the average human capital that all workers do. From equation (6) it is known that the average stock of knowledge is determined by the level of education, then based on equations (5) and (6) can be obtained:

$$H = L\frac{E\exp(E\bar{e})}{E-\sigma+\sigma\exp(E\bar{e})} \quad (7)$$

Where is the average level of education pursued in a given region, and by the combination of equations (6), equations (5), and equation (1) and considering the size per effective labour obtained:

$$\bar{y} = \bar{k}^{\alpha}\left[\frac{Ep(E\bar{e})}{E-\sigma+\sigma\exp(E\bar{e})}\right]^{\beta} \quad (8)$$

$\bar{y}$ is the output per unit of effective labour and is capital per effective labour, equation (8) shows that education is the input resulting from the existence of human capital education. Findings (C. I. Jones, 2001) found that there is a positive relationship between GDP growth and the level of education affecting the growth of a country's output.

The per capita output is obtained by combining equation (7), equation (8), and equation (5). If the educational investment is, which means educational investment per capita depends on the amount of time to pursue education, then the equation is obtained:

$$y = \bar{k}^{\beta}(Ahe)^{1-\beta} \quad (9)$$

Total production will be influenced by the total acquisition of knowledge A and the average length of time for education. In the output growth equation becomes:

$$g\ln y = (\alpha)\ln Ah + (1-\beta)\ln f(\bar{e}) + \beta\ln\bar{k} \quad (10)$$

The output growth is influenced by the growth of knowledge due to education investment (Ah) and the average growth of the school year and the growth of physical investment per capita. The growth of knowledge measured by Ah can be seen as the residual variable (Bassetti, 2008), so output depends on the level of education. The growth of output is writ-ten:

$$g\ln y = \beta_0 + \beta_i\bar{e} + \lambda_i X^T + \varepsilon \quad (11)$$

The total productivity of a production function is influenced by the average school year $\bar{e}$ of βi and the control variable influencing the acquisition of knowledge determined by external factors (X^T).

1.3 Research Model

Equation model 10 is used to explain the state of poverty in the Special Province of Yogyakarta. Assuming that the output produced by the family follows equation 11, and all outputs obtained are used to consume goods and services. The poverty rate in this study was calculated using the head count index method. Household poverty rate based on the poverty line of Central Bureau of Statistics (BPS), the line of papers is Rp 303,843.

The dependent variable is dummy variable that is poor household and not poor so this research use Cumulative Logistic Distribution Function (logit model) that is:

$$\mathrm{P(Yi = 0/Xj)} = 1 - Pi = \frac{1}{1+e^{Z_i}} \quad (12)$$

Logit model (LYi) for empirical estimation purposes, as follows:

$$\mathrm{LY_i} = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0^* + \beta_j^* X_i + \varepsilon_i \quad (13)$$

$\frac{p_i}{1-p_i}$ is an odds ratio that is defined as the ratio of house-hold probability belonging to the poor category of household probability belonging to the non-poor category. The independent variable (Xi) consists of the year of school variable and the control variable.

Table 1: Independent variables.

Year of School Variable		
MSEKO	:	Average length of school for all household members in a year
IJAH1	:	The highest diploma owned by the head of household, 1 if less than Senior High School, 0 if the high school and above.
Control variables		
UR	:	Household size in person
UMUR	:	Age of head of household in the year.
PKR	:	Work of the head of household, 1 if agriculture, 0 if non-agricultural.
SKR	:	Status of Occupation of the head of household, 1 if informal, 0 if formal.
GEO3	:	Domestic area of residence, 1 if the residence in the land area, 0 if the residence in the other part.
MPKR	:	On average all household members work in year

ε_i : Variable pester, β0: constant, βj: parameter coefficient

2 METHODS

Estimation of logit model using Maximum Likelihood Estimator (MLE) because of logit model is the nonlinear model in parameter and in variable and data used is individual data, so probability value is unknown (Gujarati, 2004). The logit model is then tested individually (partially) by testing the Z test statistic, testing the model as a whole (simultaneous) with likelihood ratio test statistic (LR), and testing the goodness of fit Goodness with McFadden R2 (R2McF). Interpretation of logit model will be distinguished by variable type that is category variable and numeric / continuous variable by looking at odds ratio and Marginal effect.

The data used in this study is secondary data with the main data derived from raw data Susenas D.I. Yogyakarta in 2013, supplemented with and supporting data including PDRB data, poverty data, public welfare indicator data (inkesra), and economic indicators. The sample numbered 3606 households.

2.1 Variable Operational Definition

Dependent variable (LYi) is household poverty status in Special Province of Yogyakarta in the form of a dummy variable, 1 if household falls into the poor category and 0 if not poor. Definition of the dependent variable and independent variable used in this re-search are:

- Household poverty status is absolute poverty, households are said to be poor if their income is not able to meet their minimum requirements. In this study, it is said to be poor if household per capita expenditure is below the poverty line of Rp303,843 per capita per month.
- Household size is the number of people living in households six months or more, or who will be living in households six months or more.
- The age of the head of the household is the age of a person of the household member who is responsible for the daily needs of the household.
- The work of the head of the household is the type of household head's work which is differentiated in the agricultural and non-agricultural sectors.
- Occupation status of head of household is the status of employment of head of household which is differentiated into non-formal (in-formal) and formal status.
- The territory of residence shall be the area of residence of the household based on the topography of the territory which is divided in-to land and non-land areas.
- The average length of school for all household members is the number of years that all household members take in formal education which is calculated to the highest level of education or the highest grade ever occupied.
- The highest diploma of household head is the highest certificate owned by the head of the household based on the highest education that is completed.
- The average member of the working house-hold is the average member of the working household and will affect the household in-come level.

3 RESULTS AND DISCUSSION

The determinant model of Special Province of Yogyakarta in 2013 provides information that the size of household heads, household heads, employment status of head of households have a positive and significant impact on household poverty status. Variable area of residence, the average length of the school of household members, the highest Owned by

the head of household, the average member of the working household and the age of the household head had a negative and significant effect on the household poverty status (Table 2).

Table 2: Estimation result of determinant model household poverty in special province of Yogyakarta Year 2013 (n = 3606).

Variable	Estimate	Zi	Odds Ratio	Marginal Effect
C*	-0.9526	-2.697	0.3857	-0.0722
IJAH*	-0.0489	-2.451	0.9523	-0.0037
MSEKO*	-0.2938	-12.17	0.7454	-0.0223
UR*	0.4420	12.749	1.5558	0.0335
UMUR**	-0.0069	-1.6986	0.9931	-0.0005
PKR*	0.7538	6.3125	2.1250	0.0571
SKR*	0.5323	3.6613	1.7028	0.0403
MPKR**	-0.3711	-1.766	0.6900	-0.0281
GEO3*	-0.4048	-3.3552	0.6671	-0.0307
R2McF		0,223584		
LR statistic (10 df)		3,35228		
Probability(LR stat)		0.000000		

*, **, significant at the 5% significance level and 10%

Test Model individually in Table 2 by comparing the Z value of statistics with Z table with the significance level () of 0.05 or 0.10. The estimation results indicate that the variables of household members (UR), occupation of head of household (PKR), employment status of head of household (SKR), residence area (GEO3), average length of member school of household (MSEKO) and diploma (IJAH) has a significant and statistically significant effect on the 5 per-cent significance level of household poverty status in Special Province of Yogyakarta. The average member of the working household (MPKR) and the age of the household head (UMUR) affect the household poverty status in D.I Yogyakarta province with a significance level of 10 percent.

From the regression result, the estimated logit model shows the LR statistic value of 718.5542. The comparison of the statistical LR value with the table value indicates that the LR value is considerably larger than the value of the table at the 0.05 significance level. This means that statistically independent variables together affect the probability of household poverty in Special Province of Yogyakarta.

Test the goodness of fit by looking at the value of R2McF of 0.223584, which means that 22.36 percent variation of household poverty status in Special Province of Yogyakarta can be explained by the variables in the model. This R2McF value is good for cross-data (Kabananukye, et.all, 2004).

The household education variable in this study is represented by the highest certificate owned by the head of household (IJAH). The 2013 logit model obtained that the highest certificate owned by the head of household has a negative and significant effect on the poor status of the household. Estimated value of 0.048922 and odds ratio of 0.9523. This means that every increase of one level of highest education certificate owned by the head of household head then the probability of the household into the poor category will be 0.9523 times the house-hold with lower education level. In other words, the higher the diploma held by the head of household, the lower the probability of the poor category of the household. The marginal effect of the highest diploma variable owned by the head of household is -0,0037, meaning the chances of household entering into the poor category will be reduced by 0.37 percent if the highest certificate owned by the head of house-hold is increased one level higher. This shows that education plays an important role in the family to get out of poverty. The higher the diploma held by the head of the household will have a large stock of knowledge and the productivity of the head of the household will increase. The head of household responsible for the fulfilment of the economic needs provided with higher formal education will have an impact on increasing the productivity, and the quality of output produced so that the wages received will increase. Households included in the poor category will be smaller. The same statement that the education of the head of the household negatively affects poverty by the re-search of Ueda, et.al (2005: 11), (Guillaumont, Guillaumont Jeanneney, & Wagner, 2017).

The variable of human resources (HR) in the research was obtained by the average variable of school length of the household member (SEKO). The result of coefficient estimate shows that the average length of the school of a member of the household has significant influence with household risk to be poor. The coefficients of the MSEKO variable are -0.293816 with the odd ratio of 0.7454. This means that every in-crease in the average length of school for one-year household members, the chances of poor households being 0.293816 households with the average length of school for smaller household members. The marginal effect of this variable indicates that the probability of households falling into the poor category in the year is reduced by 2.23

percent if there is an additional one-year-old school member household. From the interpretation of this logit model proves that education as an effort to improve human re-sources has a strong relationship with the risk of households entering the poor category. Poverty has a strong relationship with education and economic growth. Education is a multidimensional process that will impact on economic growth and, on the other hand, reduce poverty by increasing labour productivity (Brück, n.d.) et.al. (2013). A more pro-active individual with higher quality output results can earn higher wages. Education plays a very important role in building human capabilities and promoting economic growth through skills and knowledge. The results of the study (Brück, nd, et.al (2007: 26) also state that education of members of households is important in improving welfare.Babatunde & Adefabi (2005) argue that education triggers economic growth through many factors such as increased employment, Reducing fertility and poverty levels, promoting technological development, and the source of political stability Education is the first step in the path of the development process and providing the basis for improving the socio-economic conditions of a country education is considered an important instrument for reducing poverty (Jung & Thorbecke, 2003).

The number of household members has a positive and significant effect on the poverty status of the household. Each additional one household member, the chances of a household going into the poor category would be 15558 households with fewer household members. The greater the number of household members the more likely the households will be in the poor category. The marginal effect of 0.0335 means that if the mean sample of household member's increased one person, then the chances of households entering the poor category will increase by 3.35 percent. The results of this study indicate that the number of household members has a positive and significant effect on poverty, so that by the re-search hypothesis and theory. Geda, et.al (2005) in the study of the determinants of poverty in Kenya al-so stated that household size has a positive influence and an important determinant of poverty. A large number of household members will reduce the ability of households to meet the need to obtain knowledge stock through educational investment.

The coefficient of age variable of the head of household is equal to -0,006894 with odds ratio equal to 0.9931. Artiga every increase of 1-year-old head of household then the probability of the household into the poor category will be 0.99 times household with age of head of household is younger. The interpretation of this result is that the older the head of household, the lower the household risk of the poor category. The marginal effect of -0.0005, means that the increase of the sample means the age of head of household by one year, then the probability of households entering the poor category will decrease by 0,05 percent. The older age of household head of household income and household wealth is higher so that it can support sufficiently expenditure to fulfil education investment requirement. This result is no different from the research conducted by Christiaensen and Todo, 2014 in a study of the determinants of poverty in developing countries found that the age of household heads has a negative and significant effect on poverty.

The work has a high correlation to household poverty in Yogyakarta Special Province in 2013. The estimated coefficient of the household head variable is 0.753755 with an odds ratio of 2.1250. This means that households with heads of households working in agriculture have a probability of falling into the poor category of 2.1250 times households with heads of households working in non-agricultural sectors. In other words, households with heads of households working in the agricultural sector are more at risk of poverty than households with heads of households working in non-agricultural sectors. The marginal effect of household head's job variable in the agricultural sector in 2013 is 0,0571. This means that if the opportunity to enter into the poor category will in-crease by 5.71 percent if the head of households works in the agricultural sector. Households working in the agricultural sector have low productivity averages so that households with heads of households working in the agricultural sector have a greater likelihood of being poor. These results are consistent with the results of the research from Kabananukye, et.al (2004: 36) and (Geda, de Jong, Kimenyi, & Mwabu, 2005) which suggest that the agricultural sector positively affects poverty and is a strong determinant of poverty reduction.

In addition to the head of the household business field, in this study also included the variable status of the work of the head of the household. The estimation result of 2013 logit model obtained the estimated value of the coefficient of the employment status of head of household (SKR) equal to 0,532260 with ratio odd ratio 1,7028. This means that house-holds with heads of households working in the in-formal sector have a probability of falling into the poor category 1.7028 times households with heads of households working in the informal sector. Marginal effect variable occupation status of head of house-hold in the informal sector in 2013 is equal to 0.0403. This means the opportunity to enter into the poor category will increase by 4.03 percent if the head of household works in the informal sector. Based on the data of Susenas 2013, the characteristics of poor households with informal employment are most of the heads of

households with the highest degrees of primary school (71.56 percent), working in agriculture (64.65 percent) with unpaid employment assisted workers (53.65 percent), 72 percent) and those with free workers (24.88 percent). This suggests that poor households working in the informal sector are more than 70 percent educated with a low formal education so that they will have limited skills and skills. They mostly work on agricultural sectors that do not require certain skills.

Other employment variables that can describe the characteristics of poverty in D.I. Yogyakarta is the average member of the working household (MPKR). Based on the results of logit estimation, obtained the estimated value of MPKR coefficient of -0.371064 with an odd ratio of 0.6900. This means that the average number of household members working increased 1, the probability that households will fall into the poor category will be 0.6900 house-holds with fewer household members working. This means that the more stout the members of the house-hold are working, the less likely the households will be poor. The marginal effect of the MPKR variable is -0.0281, which means that households will fall into the poor category reduced by 2.81 percent if the number of working households increases by one per-son. Increasing the average number of working household members will lower the likelihood of households being categorised as poor.

The estimated value of the dummy of residence (GEO3) is significant at the 5 percent significance level with an estimated value of 0.404787, while the odds ratio of 0.6671. This means that the probability of households falling into the category of poor living in the mainland area is 0.6671 times than in non-mainland areas. These results indicate that non-land areas have a higher poverty risk than inland areas. The marginal effect of -0.0307. This means that households in the poor category for households in the mainland area will be reduced by 3.07 percent com-pared with households living in non-mainland areas. Characteristics of residence based on the location of topography turned out to affect poverty. This is be-cause the topography of the non-mainland area is made up of slopes and valleys. This region is a mountainous region so that transportation facilities are still difficult, facilities and infrastructure that support the fulfilment of household needs such as education, health, economy or entertainment is still very mini-mal. This result is not much different from the results of the study of the determinants of poverty in Kenya showing that poverty rates differ in different regions (Kabananukye, et al., 2004).

4 CONCLUSIONS

The results of estimation and analysis, obtained some conclusions as follows. Household size, age of head of household, occupation of head of household, employment status of head of household, occupation of head of household, average of working member of household, highest certificate owned by head of household, average length of school of household member And residential areas are the variables that are able to explain the characteristics of poor households in Special Province of Yogyakarta in 2013. Variables that can increase poverty by 2013 from the order of magnitude of marginal effect are: employment in the agricultural sector, informal employment status, and household size. Variables that can reduce poverty by 2013 are the area of mainland residence, the average member of the working household, the average length of the schooling of household members, the highest certificate held by the head of the household and the age of the head of the household. Increased investment of human resources through formal education can reduce the chances of poor households. In contrast, agricultural employment, informal employment status will increase the likelihood of poor households.

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