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THE IMPACT OF HUMAN CAPITAL INVESTMENT TOWARDS LABOUR PRODUCTIVITY: EVIDENCE FROM MALAYSIA

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ABSTRACT
The economic value of education, in terms of its contribution to social and private returns (Psacharopoulos, 1994), motivates individuals and countries to invest in the education industry. One of the social returns of human capital investment is an increase in productivity that leads to economic growth. This paper studies the contribution of human capital investment towards productivity. In particular, we quantify contribution of different levels of education to productivity growth at industry level in Malaysia during 2005 to 2012. The Arellano-Bond (1991) approach that uses the longitudinal data, produces efficient and reliable estimates in our case. We find that at aggregate level, primary, secondary, and tertiary education levels are all important in terms of its contribution to productivity. The more specific industry analysis however shows that primary education does not play a significant role in productive industries, whereas it is as important as any other level of education in low productive industries. We also study the impact of National Higher Education Strategic Plan (NHESP) 2007 policy during our sample period on productivity growth and subsequent policy change in 2009 due to change in the regime.

JEL classification*: E24, I26, J24.*
Keywords*: Human capital investment; labour productivity; education return.*

1. INTRODUCTION
A number of studies have discussed the importance of education and quantified the returns to education in term of social and private returns. These studies found that education plays an important role both from the private and social point of views, which makes it as an important industry to invest (Psacharopoulos, 1994). Although education provides high rates of private returns, there are also chances where the returns gained to the economy could exceed the private returns due to the spillover of private returns to education (Blundell et al., 1999). Investment in private human capital is argued to lead

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an increase in individual’s earning and improve their chances of employment or reduces their risk of being unemployed. Although certain studies found that tertiary education does reduce the uncertainty of employment, but at times it also increases the volatility of earning (Brown et al., 2012)[1]. Social returns to human capital investment on the other hand leads to an increase in productivity that induces economic growth (Rumberger, 1987). In 1961, Schultz’s preliminary work on human capital investment suggests that the increase in the rate of interest in human capital might be an important key to economic growth. Later, in the new growth theories, human capital is viewed as the primary source of innovation that increases individuals’ capacity to produce more. The education levels as human capital stocks, hence are linked to productivity growth (Blundell et al., 1999).

Different studies use different approaches to measure returns to education. Expenditure approach and production function approach were broadly used in the earlier years of human capital study (Ben-Porath, 1967; Becker, 1962; Schultz, 1961). Later, Mincer introduced earning function approach (Heckman et al., 1996; Mincer, 1997, 1970; Mincer & Higuchi, 1988). On the other hand, some advanced studies have proposed the use of cost-benefits based approach (Fiszbein & Psacharopoulos, 1993; Cohen, 1985). However, the use of earning function approach should be preferred if the data at the firm level appear to be limited. This paper focuses on the ‘Mincerian’ approach where productivity is used as proxy to earning at aggregate level. In the standard model, earning is returns of human capital investment at micro level.

There is mixed evidence on the link between education in both private and social return to education. Mincer (1994) and Blundell et al., (1999) in their study found that investment in education is positively related with private returns, while Black and Lynch (1996) found the average education level has a positive impact on productivity in both manufacturing and non-manufacturing sectors. In contrast, Chevalier (2004) claimed that there is only little evidence that education enhances productivity. In fact, Hwang et al., (2013) found that in developed country, high investments in higher education increase unemployment rate.

Our study aims to examine the relationship between education and productivity, and quantify the impact of different levels of education on productivity. We also investigate whether the human capital theory, where more educated labours are more productive, is consistent across industries. We use panel data set for 15 states of Malaysia 2005 to 2012. To the best of our knowledge, this is the first attempt that studies the impact of different levels of education on labour productivity in Malaysia. We do this analysis at the aggregate as well as industry level. We also investigate the impact of different government policies on education introduced during our sample period.

2. EDUCATION AND PRODUCTIVITY

Physical and human capital are commonly used as two major inputs of productions in the economic growth literature. Education is considered as an important determinant of the human capital which is intangible product (Dale W. Jorgenson & Fraumeni, 1992). The

[1]Whereas the risk aspect of education is interesting especially at micro level, like most of other studies such as (Abowd et al., 2005; Haltiwanger, Lane, & Spletzer, 1999), we focus on return to education in term of labour productivity due to data availability constraints.

intangible nature of human capital possesses a problem that relates to its measurement. Different studies have used different proxies to quantify human capital, some studies used the years of schooling (Ritzen & Winkler, 1977) as proxy for human capital, while others used school enrollment (Barro, 2001; Schultz, 1961), enrollment ratio (Benhabib & Spiegel, 1994; Barro & Lee, 1993;) and average level of education (Black & Lynch, 1996). Then, the question arises on how do we measure the output of education? The early work on human capital investment, especially in education and training measured productivity as proxy to return of investment (Chevalier, 2004; Moretti, 2004;Black & Lynch, 1996; Rumberger, 1987; D. W. Jorgenson & Griliches, 1967). This paper focuses on standard measures of level of education, namely primary, secondary, and tertiary.

In order to get a context for our model, let us consider the standard Mincer's individual earning model.

$$\ln Y_t = \ln Y_{t-1} + rE$$

In the model, Y_t and Y_{t-1} are defined as the individual's earning at t years of schooling and individual's earning at previous year of schooling accordingly, while rE refers to the rate of return to schooling years. Mincer model indicates linear relationship between log earnings and years of schooling.

There are a few studies stated in Psacharopoulos (1994) that fitted the earning model into aggregate level. Those studies extended the earning function approach to estimate returns to education at different levels by incorporating dummy variables for each of the main schooling cycles namely primary, secondary, and tertiary. In another study of aggregate level, instead of using dummy variables, enrolment ratios, educational attainment of the labour force and school enrolment were used to represent different level of education as human capital stock. These data were first published in Kyriacou (1991) then used in Benhabib & Spiegel (1994).

Nevertheless, in contributing to the study, we extend the earning model by incorporating the ratio of labour employed for each education level as proxy to investment level in human capital and regress it with productivity growth. Our model given is as follows:

$$\ln \frac{y_t}{l_t} = c + \alpha \ln \frac{y_{t-1}}{l_{t-1}} + \sum_{r=1}^{n} \beta E_r$$

Y is real GDP and l stand for total employed labour whereas in sequence $E_1, E_2, \ldots, E_n$ is the ratio of labour employed with tertiary education, secondary education and primary education.

3. DATA AND METHODOLOGY

The longitudinal data sets used in this paper contain 15 states and 13 industries that do not have homogenous properties, and the fact that it is only have 8 years' times variants lead us to apply Arellano-bond (1991) approach that suitable for data with small T and large N (Arellano & Bond, 1991). The dynamic approach also extends GMM model by eliminating fixed individual effect, heterokedasticity, and autocorrelation within the cross sectional data (Roodman, 2009). Although there are some limitations in Arellano-bond (1991) approach, we find that the assumptions on the model do not affect our balanced panel data. The model also allows us to introduce more instruments to estimate as we fulfill the assumption of T≥ 4. We are not only able to estimate the effect of labour with tertiary education level, but also able to estimate labour with secondary, primary, and no education level effect towards labour productivity (output per person employed) and control for inflation and policy changes in the country.

The modelling starts with a simple earning function model with dependent lagged variable as it is assumed that labour productivity does not change instantaneously:

$$\ln \frac{y_{it}}{l_{it}} = c + \alpha \ln \frac{y_{i,t-1}}{l_{i,t-1}} + \beta_1 E1 + \beta_2 E2 + \beta_3 E3 + u_{it}; |\alpha| < 1; i = 1,2,\ldots,N; t = 2,3,\ldots \quad (1)$$

$\frac{y_{it}}{l_{it}}$ in equation (1) is labour productivity construct from GDP (y_{it}) divided by total employed person (l_{it}), while $\frac{y_{i,t-1}}{l_{i,t-1}}$ is the lagged value of labour productivity. The i, t in the equation (1) is cross section and time series properties, respectively and u is the error term. E1, E2, E3 are labour with tertiary, secondary, and primary education level accordingly.

The Arellano-Bond (1991), difference GMM estimator extends the model to the first-differencing transformation that eliminates individual effects η_i and to obviate the autocorrelation problems from any misspecification in the model:

$$\Delta \ln \frac{y_{it}}{l_{it}} = c + \alpha \Delta \ln \frac{y_{i,t-1}}{l_{i,t-1}} + \beta_1 \Delta E1 + \beta_2 \Delta E2 + \beta_3 \Delta E3 + \Delta u_{it} \quad (2)$$

From equation (1), the error term from the model $u_{it} = \eta_i + \nu_{it}$ contained time-invariant states characteristics also known as fixed effect. The fixed effect consists η_i, unobserved states-specific effects and, v_{it} the disturbance term in labour productivity. The states individual effect, η_i are positively correlated with the lagged dependent variable, hence the model emulate autocorrelation. After the transformation of the model in equation (2), we get:

$$\Delta u_{it} = \Delta \eta_i + \Delta \nu_{it} \quad (3)$$

Where, $\Delta \eta_i = \eta_i - \eta_i$ and $\Delta \nu_{it} = \nu_{it} - \nu_{i,t-1}$.

Hence $\Delta u_{it} = \Delta \nu_{it}$ (4)

Equation (4) explains on the moment condition, where the assumptions of the error terms u_{it} are serially uncorrelated and the model in equation (2) is fit for our panel data estimation as long as we obtain a significant value of dependent lagged variable. The insignificant value of dependent lagged variable might lead to unsatisfactory result due to the estimation of weak instruments (Blundell & Bond, 2000).

The study is not solely aims to determine which education level contributes more in labour productivity, but also aims to examine if the policy changes affect productivity growth in Malaysia. In order to account for the policy effect, we introduce two dummy, D_1 and D_2 in the additive regression model. The first dummy D_1 is the National Higher Education Strategic Plan (NHESP) 2007, the policy was introduced in order to emphasise the development of human capital investment in Malaysia (Abdullah & Abdul Rahman, 2011). The second dummy, D_2 is the changed of government organisation in 2009. We also assumed that both policies, might take a year lagged to show any effect, hence D_1 is 1 if $D_1 > 2008$ and D_2 is 1 if $D_2 > 2010$. The dummy variables were also included in the model to avoid a bias assessment and to account for more fully response variables by reducing errors of the model as shown in equation (5).

$$\Delta \ln \frac{y_{it}}{l_{it}} = c + \delta_1 D_1 + \delta_2 D_2 + \alpha \Delta \ln \frac{y_{i,t-1}}{l_{i,t-1}} + \beta_1 \Delta E1 + \beta_2 \Delta E2 + \beta_3 \Delta E3 + \Delta u_{it} \quad (5)$$

Aside from Arellano-Bond (1991) method, we also extend the test at industry level for two different sample groups; high productivity and low productivity industry.

4. RESULT AND ANALYSIS

We begin the empirical test by investigating the impact of labour with tertiary, secondary, and primary education level ratio towards labour productivity growth at two groups of industry; high productivity and low productivity industry. Table 1 shows the estimation results for two groups of industry, Y1 ($\frac{lny1_{it}}{l1_{it}}$) indicates an estimation model for high productivity industry, and Y2 ($\frac{lny2_{it}}{l2_{it}}$) indicates an estimation model for low productivity industry.

In Table 1, a non-significant constant means that labour productivity is at zero when there are no changes in all of the explanatory variables. Therefore, all the parameters estimated in the model explained the properties of labour productivity. The coefficient of one-year lagged in labour productivity for all the models are significant at 1% showed the current labour productivity growth related to its past value. In GMM model, Sargan test was used to test for over-identifying restriction and for second order autocorrelation in the first differenced errors. However in Arellano-Bond (1991), x^2Wald-test was used instead to serve the two tests. The high significant value result of x^2 Wald test in table 1 indicated that all the models estimated fail to reject the null hypothesis of valid instruments and no autocorrelation.

The coefficient of one-year lag of labour productivity in Table 1 indicates that an increase in any of the explanatory variables and inflation will add an additional increase in the following year labour productivity growth by 0.81% in high productivity industry and 0.52% in low productivity industry. The dependent lagged variable coefficient in model 1, Y1 for high productivity industry is higher compare to the coefficient in Y2 for low productivity industry, this means that the labour productivity growth of high productivity industry is slower than low productivity industry. The result also display coefficient for all explanatory variables in Y2 higher than Y1 in model 1. A unit increase in the ratio of labour with tertiary, and secondary education level, will increase labour productivity in the next period by 2.30% and 3.12% in low productivity industry and only 1.31% and 1.28% in high productivity industry accordingly. However, the ratio of labour with primary education in high productivity industry not only obtain a non-significant weak coefficient but it is also three times lower compare to 3.37 of coefficient in low productivity industry. We also observe that in model 1, inflation do not have significant impact towards the labour productivity growth in low productivity industry. This conclude that the impact of ratio labour at all education level towards labour productivity growth is better explained in Y2.

Table 1: Labour productivity of productive and low productive industry against employed workers by education level distribution in Malaysia.

Model	1		2		3	
Variable	Y1	Y2	Y1	Y2	Y1	Y2
lag 1	0.8066566***	0.5243555***	0.7724988***	0.5936906***	0.7629783***	0.6433347***
Tertiary	1.310807**	2.303533**	1.189423*	2.604027**	1.201772*	2.83064**
	(0.5728146)	(1.018681)	(0.6450172)	(1.251997)	(0.6418179)	(1.292004)
Secondary	1.276664**	3.115183***	1.055366*	3.44256***	0.9812229	3.287688***
	(0.5416748)	(1.094646)	(0.6197831)	(1.252053)	(0.6276723)	(1.284458)
Primary	1.068795	3.36395***	1.056299	3.562411***	0.9068738	3.17035**
	(0.6551441)	(1.199912)	(0.686994)	(1.26395)	(0.7086341)	(1.319862)
Constant	-0.4460272	-0.8642997	-0.1685705	-1.440758	-0.0595991	-1.511207
Inflation	0.0090522***	0.0075013	0.00923***	0.0074431	0.008809***	0.0056139
$D_{1\ (2008)}$			0.0030818	-0.0014437	-0.0018893	-0.0255424
$D_{2\ (2010)}$					0.0068368	0.0315936
Wald Chi^2 (K)	291.5(5)***	31.12(5)***	302.54(6)***	34.34(6)***	305.88(7)***	34.72(7)***

Note: The independent variable for each of the education level is in ratio value (industry employed/total employed) and the *log* labour productivity is log GDP/total employed. **p < 0.1, **p <0.05, *** p <0.0*

As shown in Table 1, for model 1 of Y1 and Y2, we run a restriction test on the parameters. The result of the first restriction test $p(x^2 < 0.39) = 0.8210$, fail to reject the null hypothesis and conclude that at high productivity industry, labour at all education levels is equally an important contributor towards labour productivity growth. Conversely, in low productivity industry, the result of the first restriction test $p(x^2 > 8.05) = 0.0179^{**}$, rejects the null hypothesis and indicates that the coefficient of labour at tertiary, secondary and primary education level is not equal to each other. Hence, this leads to additional restriction test on the parameters for low productivity industry. For restriction test on tertiary and secondary parameters, the result of the test is $p(x^2 < 1.07) = 0.3010$, fails to reject the null hypothesis. Whereas, in the restriction test for tertiary and primary parameters, we reject the null hypothesis as the result show $p(x^2 > 6.95) = 0.00^{***}$. Last, we test for restriction between secondary and primary, the result obtained is $p(x^2 < 0.08) = 0.79$, fails to reject the null hypothesis. Thus, in low productivity industry, we find that the impact of labour with tertiary education is lower than the impact of labour with primary education but equal to the impact of labour with secondary education.

Table 1 also shows a comparison result between the high productivity and low productivity industry in model 2, inclusion of D_1 and model 3 inclusion of both dummy D_1 and D_2. The result for both models showed that the entire additive dummy variable (0.003, -0.001) have insignificant effect on labour productivity growth neither in high productivity industry nor in low productivity industry. Hence, there is no intercept for both of the regression functions. Nevertheless, we observed that the NHESP policy, for strengthening the human capital accumulation had a contradicted impact between the two industry groups.

Both model 2 and 3 also indicate that the coefficient of labour with tertiary, secondary and primary education level is decreasing in high productivity industry and increasing in low productivity industry in comparison with the model 1 and vice versa for the coefficient of lagged one year labour productivity. In model 3, when D_2 is incorporated in the model, only the coefficient of labour with tertiary education level is significant while the other explanatory variables obtain insignificantly weak coefficient at high productivity industry. On the contrary, the low productivity industry obtains a consistent high significant coefficient for all the explanatory variables. The result also indicates that the government policies widen the gap between the coefficient of labour with tertiary, secondary and primary education level of the two industry groups in model 2 and 3.

5. DISCUSSION AND CONCLUSION

In general, the results in section 4 show that:

a) The ratio of labour at all education level is positively affecting labour productivity growth and the current labour productivity is significantly depending to its past value at aggregate level and industry level.
b) The ratio of labour at all education levels is equally an important contributor towards the labour productivity growth at aggregate level and in productive industry, but not in low productive industry.
c) The NHESP (2007) policy at both aggregate and industry level has insignificant weak impact on labour productivity growth and the policy change due to the changed of prime minister in 2009, showed a significant result only at aggregate level. However, the significant result indicates a negative impact of the changes as it has slow down the growth of Malaysia labour productivity.

We expect that labour with higher level of education would have higher contribution in labour productivity growth, however our result shows that in Malaysia high productivity industry, labour at all education level are equally an important contributor to labour productivity growth where $E1 = E2 = E3$ and in low productivity industry the highest contributor towards labour productivity growth is labour with primary education level where $E3 > E1 = E2$. In theory, this indicate that additional schooling in Malaysia does not contribute much on the social benefits. This is because tertiary education impact towards the country labour productivity growth is equal to secondary and primary education impact. The finding however similar to Psacharopoulos (1994) conclusion where studies from developing countries find returns to investment in primary education level are largest compare to secondary and tertiary education level. Therefore, our results prove that Becker (1962) human capital investment theory - more educated labours are more productive do not apply in Malaysia labour market and developing country in general.

However, we could not conclude that additional schooling is completely unproductive, rather as mentioned in Rumberger (1987) that the positive low impact of higher education towards labour productivity might be caused by job mismatch. The limited suitable job creation could simply place higher educated worker in a job that constrain the ability of worker to fully utilise the skills and knowledge. A study by Bartel (1994) and Black & Lynch (1996) found that formal training program increases labour productivity. The finding has established a linkage between labour productivity and training. Hence, this raises uncertainty about the effectiveness of on-the-job training program in Malaysia.

Aside from that, there is also uncertainty on the effect of policy introduced by the country. The NHESP policy is one of many tools of fiscal policy that introduced to boost Malaysia economics level to high-income knowledge based economy by 2020. The implementation of the policy is assumed to have a positive impact on education sector and indirectly to the labour productivity growth (Salleh et al., 2013; Abdullah & Abdul Rahman, 2011). Nonetheless, our results do not show significant impact on the labour productivity neither at aggregate level nor at productive and low productive industry level. Does the change in the government organisation on 2009 disrupt the efficacy of NHESP policy? We do not find any evidence in our study to prove on that point. Henceforth, it would be interesting to further the study on the cause of the effects of government policies towards growth in human capital investment. As states in Schultz (1961), "Policy all too frequently concentrates only on the effects, ignoring the causes. Past mistakes are, of course, bygones, but for the sake of the next generation we can ill afford to continue making the same mistakes over again." (14).

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