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Education, Labour Productivity and Industrial Performance: Evidence of Indonesia

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Abstract

The successful of Industrial development is determined by the quality of human resources. Therefore, an improved schooling policy is a central part of development strategies to result more skilled labour. The government allocates more funds to improve the education sector. This paper investigates relationship between education, productivity and industrial performance. To do such, this paper used regression analysis based on panel data model. In the first equation, we regress labour productivity on education and wage. Hereafter, in the second equation, we regress industrial performance on fitted value of labour productivity and infrastructure. The results show that there is evidence that education has a positive impact on labour productivity. Education is an instrument to boost labour productivity. It is true that increased education has led to an increase in the labour productivity. Furthermore, labour productivity is associated with industrial performance. An increase of labour productivity leads to an increase of industrial performance.

Keywords: education, productivity, labour, industrial, performance,

1. Introduction

Education is a central issue in Indonesia's strategy to increase their standard living. Education development is recognized as an instrument to raise labour productivity. Then, raising labour productivity is a critical factor for increasing economic growth and reducing poverty levels (Duryia and Pages, 2002). Some researcher generally support validation of Becker's human capital theory where more educated individuals are more productive. Most economists regard human capital, particularly schooling, as one of the key factors driving growth. Societies with a better endowment of human capital are considered to have a greater development potential than those with scarce or inadequate human resources (de la Croix and Vandenberghe, 2004).

The importance of human capital for growth is also stressed by Boucekkine, de la Croix, and Licandro (2001). They show that the endogenous growth arises thanks tothe accumulation of generation-specific human capital. Human capital, in particular larger shares of university-educated workers inside firms, translate into significantly higher firm-level labour productivity(de la Croix & Vandenberghe, 2004).High-tech equipment can only be performed by educated worker. This means that the better technology is of little value to economies that have very few skilled workers. Economic growth closely depends on the synergies between new knowledge and human capital.

The human capital perspective views education as directly affecting labour productivity through creation of skills. By creating skills that enhance labour productivity, education is seen as a force directly influencing economic activity and social welfare. Education is a productive input that enhances labours' contribution on production process. By employing educated worker, the production process can be done efficiently and effectively. A large increase in education attainment has taken place in all countries that have achieved significant economic growth. Skilled workforce is one of the most important sources of economic growth. Human capital is responsible an important role in process development of advanced industrial countries (Tabari and Reza, 2012).

Education condition in Indonesia is reflected by the quality of human resources. Qualified human resources has a central role in implementing national development and facing the challenges in the globalization era. The Global Competitiveness Report stated that Indonesia is ranked 34th (from 38th in last year's edition of the index). Since the 2012-2013 edition, when Indonesia was ranked 50th, the country has risen steadily. The Global Competitiveness Index measures the institutions, policies, as well as factors that set the sustainable current and medium-term levels of economic prosperity among 144 countries around the world. Although, Indonesia has jumped four places in the World Economic Forum's Global Competitiveness Index 2014-2015, this rank is lower than that of Singapore, Malaysia and Thailand.

In line with Indonesian industry development, there is a strong and growing demand for high-skilled human resources. To cope with this expected increased demand for high-skilled workforce, the Indonesian economy will need higher enrolment from students in its higher education. To do this, the university programs must improve their education quality so there is a suitability between skill of college graduates and the market requirement. Education program must eliminate skills mismatch between the demands of the job market and the skills of the university graduates. With rich natural resources, Indonesia should have been able to use its manpower to develop its natural resources for the prosperity of its people. In national development, there are two important elements apart from technology and innovation, namely natural wealth and human resources. Natural resources will be meaningless and will not be able to create prosperity for the people if they are not developed by competent and skilled manpower. Manpower has strategic position and plays an important role in development.

In spite of increased years of schooling and greater overall participation in higher education, graduates are found to be unprepared for the job market. This condition is consistent with the quality of the labour force that is reflected from the value of the Indonesia human development index (HDI). Indonesia human qualities, reflected in life expectancy, literacy, education and standard of living, is lower than that in the these countries.

The human quality has impact on labour productivity. Higher HDI reflect higher labour productivity. More productive workers can produce more output. The industries employing productive workers will be able to achieve better performance. Skills and knowledge are central issues to improve employment outcomes and increase productivity. Indonesia has crucial manpower problems and need to improve the competitiveness of its workforce so they can compete in the ASEAN labour market. The demand for skills tend to rise because of the comparative advantage that educated workers have in implementing new technology. To encourage higher productive workers, Indonesia need the cooperation between universities and industrial sector so that any effort performed by universities suitable for the job market demand (Susanto and Windyastuti, 2011).The remaining part of the paper is organized as follows: section 2 presents the literature review, section 3 present the

methodology of the study. Empirical results are examined in section 4. Finally, section 5 provides conclusion.

2. Literature Review

The idea that educational attainment is likely to influence a nation's output of goods and services rests to a large degree on the acceptance of schooling as a process that enhances the individual's skills in the work place. Individual with primary schooling, for example, are more productive than those with no formal education. An individual with a higher level of skills is likely to contribute more to production than is one with alower level of skills. University education play positive external role through endogenous technical progress and competitive diffusion to improve know how through innovation and imitation (Sarquis and Arbache, 2002).

Education teaches workers valuable skills which make them more productive. Generally, education through the following increase workforce productivity: 1) Educated people are doing more work at the same time and their work has a higher value in addition to have high efficiency increase the efficiency of the group. 2) Educated people lead to increase the final factor in the productivity of capital and in particular, production equipment and facilities and increasing the national production provide areas to achieve economic growth in the community. 3) Educated people will find lead to suspend the law of diminishing returns, in practice. Also cause the increased levels of technology manufacturing enterprises. 4) Educated people on equal terms, able to carry out the invention, exploration and innovation. 5) Educated people can create major developments at industrial countries with the optimal allocation scarce resources, and with savings due scale they contribute to more economic growth (Tabari and Reza, 2012).

Education exercises an impact on the speed of technological catch-up and diffusion(Benhabib and Spiegel, 2002). It facilitates the ability of nation to adopt, assimilate and implement technologies from other countries and determines the ability of a nation to innovate domestically. Education improves workers' access to information and their ability to understand new information. Better educated workers are more able to adapt to technological change and will introduce new production techniques more quickly. Education speeds the process of technological diffusion.

The lack of well-educated people could mean that the country has non-ability to use or create new technologies. Education is a prerequisite for economic and total factor productivity growth through its contribution to both adoption and innovation. The ability of nation to adopt, assimilate and implement new technologies should depend on education level. The most highly qualified people are, the greater the production is. Educated worker facilities the innovation of new ideas, new technologies and new products. They contribute moreover significantly to the adoption and the use of technologies developed by more advanced countries. Therefore education increases the probability of successful and early adoption of innovations. Efficiency improvement depends on the sector in which people work. Education can influence productivity by stimulating technological progress and increasing the efficiency (Ping HUA, 2005).Higher proportions of highly-skilled workers relative to low skilled workers, would be expected to lead to higher growth.

In general, productivity is often defined as a relationship between output produced by a system and quantities of input factors utilized by the system to produce that output. Here, the output can be any outcome of the process, whether a product or service, while input factors consist of any human and physical resources used in a process. It follows that, in order to increase productivity, the system must either produce more or better goods from the same resources, or the same goods from fewer resources. Stated differently, productivity

improvement refers to an increase in the ratio of produced goods or services in relation to resources used (Pekuri *et al*, 2011).

Productivity has been a matter of interest since the beginning of industrialization. Productivity is perhaps one of the most important and influential basic variables governing economic production activities (Tangen, 2005). While high productivity can be a significant source of competitive advantage for companies, it also contributes to the general well-being of a society. Due to the size of the construction industry, productivity trends in this industry have notable effects on national productivity and on the economy as a whole (Allmon *et al*., 2000). The increased pressure of global competition has forced companies and authorities to put even greater emphasis on productivity improvements.

3.Methodology

The secondary data which published by Indonesian Statistics was used in this research. The data are education, labour productivity, industrial performance and infrastructure in Indonesia during 2002-2012. The industrial performance data cover six manufacturing industries. The six industries are food and beverages, textile, apparel, leather and related products, paper and paper product, and rubber and plastic product. As the first main explanatory variables, education is measured by school participation rate,where as industrial value added is used as proxy for industrial performance. The second main explanatory variable, labour productivity is calculated through the division of real GDP by the number of labour force. Then, as a proxy for infrastructure, we used the length of road per 1,000 km^2 land area.

The research data cover six industrial data during 2002-2012, therefore the data is known as panel data. The panel data is a data sets that combine time series and cross sections. This data sets provide rich sources of information about the economy. The analysis of panel data allows the model builder to learn about economic processes while accounting for both heterogeneityacross individuals, firms, countries, and so on and for dynamic effects that are not visible in cross sections (Greene, 2001).

With panel data, the most commonly estimated models are probably fixed effects or random effects models. It is crucial in panel framework to decide which of the two estimators fixed effects or random effects models one uses. The Hausman specification test which is based on the difference between the fixed and random effects estimator is usually used to decide whether to use fixed and random effects. A rejection of the null hypothesis leads to the adoption of fixed effects model and non rejection leads to the adoption of the random effects model.

First, this paper examined the response of labour productivity to change in school participation rate. Therefore, in the first equation, we regress labour productivity on education and wage. The first estimating equation can be written as follows:

$$Y_{it} = \alpha_{1it} + \sum_{j=1}^{k} \alpha_{2ij} Y_{it-j} + \sum_{j=0}^{k} \alpha_{3ij} X_{1,it-j} + \sum_{j=1}^{k} \alpha_{4ij} X_{2it-j} + e_{it} \qquad \textbf{(1)}$$

Where Y represent labour productivity, X_1 and X_2 respectively represent education and wage.

Second, another goal of this study is examined the effects of labour productivity on industrial performance. Thus the education effect on industrial performance will depend on the labour productivity. In the second equation, we regress industrial performance on fitted value of labour productivity and infrastructure. The second estimating equation can be written as follows:

$$G_{it} = \beta_{1it} + \sum_{j=1}^{k} \beta_{2ij} G_{it-j} + \sum_{j=0}^{k} \beta_{3ij} Y_{,it-j} + \sum_{j=1}^{k} \beta_{4ij} X_{3it-j} + \varepsilon_{it} \quad \textbf{(2)}$$

Where G represent industrial performance, where as$Y$ and X_3 respectively represent labour productivity and infrastructure.

4. Empirical results

4.1 Education Impact on Labour Productivity

In line with co-integration principle, we use the Pedroni co-integration test to examine whether there is a co-integration relationship among variables in the model. The results of the within-group tests and the between-group tests show that the null hypothesis of no co-integration can be rejected (Table 1). There is a long run relationship among labour productivity, education and wage which implies that the variables are attracted to a stable long-run (equilibrium) relation and any deviation from this relation reflected just short-run (temporary) disequilibrium.

Table 1.
The Results of Pedroni Cointegration Test
(Labour Productivity Model)

Statistic Panel	Statistic	Probability
Panel v-Statistic	0.301	0.381
Panel rho-Statistic	-0.428	0.364
Panel PP-Statistic	-3.388 *	0.001
Panel ADF-Statistic	-3.751*	0.000
Group rho-Statistic	0.875	0.272
Group PP-Statistic	-3.309*	0.002
Group ADF-Statistic	-3.281*	0.002

* Indicated significant at 5%

In order to obtain parsimonious model we implement lag length selection criteria. Lag selection is crucial issue in dynamic modeling. Model with too short lag can lead to a miss specified model, meanwhile too long lag can lead to diminish degree of freedom. To obtain optimum lag we implement Akaike's Information Criteria (Liew, 2004). Based on Akaike's Information Criteria (AIC), the optimum lag length is 2 year. Furthermore, to test which a model is appropriate (fixed effects or random effects models), we apply Hausman test.The magnitude of $X^2$is 12.6045 and statistically significant so the fixed effects model have advantage than random effects model. This result show that fixed effects model is appropriate model so there are differences in intercept across a groups. Then, based on estimation of the fixed effects model and reduction of the insignificant parameters, we obtain a parsimony model (Table 1).

Table 2. Education Effects on Labour Productivity
(Fixed Effect Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANTA	-300.686	163.834	-1.835	0.071
$PRODUCTIVITY_{t-1}$	0.790	0.071	11.018	0.000
$EDUCATION_{t-2}$	9.190	4.905	1.873	0.066
$WAGE_{t}$	-0.031	0.021	-1.512	0.136
$WAGE_{t-1}$	0.038	0.019	1.951	0.056

Adjusted R^2 = 0.946
Number of observation = 66

Table 2 show that together the independent variables explained 94,6% of the variance in the dependent variables. The regression coefficient of previous labour productivity statistically significant. This condition indicate that if the previous labour productivity increase by 1 thousand rupiahs, current labour productivity up by 0.790 thousand rupiahs. The company's manager always improve labour productivity. Furthermore, there is a positive impact of wage on labour productivity. An increase in wage, lead to an increase in labour productivity. An increase in wage by 1 thousand rupiahs, on average, labour productivity up by 0.038 thousand rupiahs. Labour productivity growth at the industry level is driven by process innovation. Higher wage rate create stronger incentives for process innovations that raise the labour productivity so an increase in wage rate lead to an increase of labour productivity.

Meanwhile, the regression coefficient of education is statistically significant. This result show that education has a positive impact on labour productivity. If school participation rate goes up by 1 percent, on average, labour productivity increase by 9.190 thousand rupiahs. Education teaches workers valuable skills which make them more productive. Education improves workers' skill and their ability to understand new information. Better educated workers are more able to adapt to technological change and will produce more quickly. The most highly qualified people are, the greater the production is. Educated worker facilities the innovation of new ideas, new technologies and new products. This results confirm the studies of Tabari and Reza (2012) that there is a long run relationship between labour productivity growth and workforce, technology-education and physical capital growth in Iran. Technology and education have positive effects on labour productivity in the agricultural sector and is regarded as an important factor in agriculture development in Iran.

4.2 Productivity Impact on Growth

Using Pedroni panel co-integration test, we check whether the variablesof this model has a long run relationship or not. The test result give strong evidence that the null hypothesis of no co-integration can be rejected. The variables of this model has long run equilibrium (Table 3). A deviation from this relation, if any, reflected just short-run (temporary) disequilibrium.

Table 3.
The Results of Pedroni Cointegration Test
(Growth Model)

Statistic Panel	Statistic	Probability
Panel v-Statistic	3.839*	0.000
Panel rho-Statistic	0.590	0.330
Panel PP-Statistic	-5.279*	0.000
Panel ADF-Statistic	-4.977*	0.000
Group rho-Statistic	1.197	0.195
Group PP-Statistic	-13.185*	0.000
Group ADF-Statistic	-8.655*	0.000

* Indicated significant at 5%

Lag selection is crucial issue in dynamic modeling because model with too long lag can lead to diminish degree of freedom, where as model with too short lag can lead to a miss specified model. To obtain optimum lag we implement Akaike's Information Criteria (Liew,

2004). Based on Akaike's Information Criteria (AIC), the optimum lag length is 2 year. Furthermore, we test which model is appropriate (fixed effects or random effects models), using a Hausman test. The result show that fixed effects model is more appropriate than random model. The magnitude of $X^2$is 13.138 and statistically significant so the fixed effects model have advantage than random effects model. Furthermore, based on estimation of the fixed effects model, we implement redundant variables test whether a subset of variables in an equation all havezero coefficients and might thus be deleted from the equation. Using the redundant variables test, we obtaina parsimony model as follow (Table 4).

Table 4. Education Effects on Labour Productivity (Fixed Effect Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANTA	-8.979	3.352	-2.679	0.0097
$PERFORMANCE_{t-2}$	1.123	0.072	15.553	0.0000
$PRODUCTIVITY_t$	0.012	0.005	2.205	0.0315
$PRODUCTIVITY_{t-2}$	-0.006	0.007	-0.863	0.3919
$INFRASTRUCTURE_{t-1}$	0.524	0.265	1.979	0.0527

Adjusted $R^2 = 0.948$

Number of observation = 66

Table 4 show that all variables included in the model are statistically significant. The slope coefficient of about 1.123 means that an increase in the previous industrial performance of 1 billion rupiahs, on average, lead to about 1.123 billion rupiahs increase in current industrial performance. This condition indicates that an continuous improvement always happened in the Indonesian industrial sector. Hereafter, infrastructure has positive impact on industrial performance. An increase in the length of road by 1 kilometer (per 1,000 km^2 land area), on average, industrial performance goes up by 0.524 billion rupiahs. Infrastructure investments can accelerate industrial development. Better infrastructure lead to higher industrial performance growth

Furthermore, labour productivity has positive impact on industrial performance. An increase in labour productivity by 1 thousand rupiah, on average, industrial performance up by 0.012 billion rupiahs. Labour productivity is the cornerstone of industrial performance growth. Labour productivity is the source of competitive advantage for companies, and contributes to the general well-being of a society. The labour productivity variable in second equation is a fitted value of labour productivity that resulted in the first equation. This indicate that educationis associated with productivity. Indirectly, education has positive impact on growth through labour productivity. Countries that invest the most in education also tend to grow faster and to be the richest.

This finding confirm the studies of Allmon *et al*. (2000) thatproductivity trends in this industry have notable effects on national productivity and on the economy as a whole. While high productivity can be a significant source of competitive advantage for companies, it also contributes to the general well-being of a society. This results also confirm the studies of Tangen (2005) that productivity is perhaps one of the most important and influential basic variables governing economic production activities.

5. Conclusion

There is an evidence that education has a positive impact on Indonesian labour productivity. Education is an instrument to boost labour productivity. An increased in education has lead to an increase in the labour productivity. The most highly educated people

are, the greater the production is. Educated worker facilities the innovation of new ideas, new technologies and new products. labour productivity is associated with industrial performance. Furthermore, an increase in labour productivity lead to an increase in industrial performance. High productivity is associated with competitive advantage for companies. Productivity trends in this industry have notable effects on national productivity. It is recommended to encourage investment in education by internal and external resources Education is crucial factor to improve labour productivity so kindly the government increase compulsory education to 12 years. If there is not enough money for it, the government can introduce it gradually.

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