EDUCATION IN INDONESIA'S REGIONAL ECONOMIC DEVELOPMENT BEFORE FISCAL DECENTRALIZATION

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Abstract

Indonesia is a diverse country with uneven resource endowment across its provinces. This study examines the effects of human capital investment policies on the promotion of more equitable income growth across provinces. First, the rate of return to education is estimated for each province using the 1976 and 1989 Indonesian National Labor Force Surveys (SAKERNAS). Then, regional economic indicators are used to explain differences in the rates of return to education among provinces and to develop and test hypotheses regarding the contribution of investment in education to personal income growth in different regions in Indonesia.

The study finds large differences in the rates of return to education among provinces with the highest rates of return in the poorest provinces. A model of segmented regional labor markets is advanced to explain why wage differences across provinces may exist. The estimates suggest that labor market segmentation was more pronounced for un- or low-educated workers because inter-provincial differences in wages were greater among this group than among more educated workers. Education may reduce regional labor market segmentation. More educated workers may be better able to compete for jobs in other provinces, and therefore more mobile, because they possess the needed language and market skills.

Thus, it appears that education not only enhances personal (and national) income, but also promotes greater equity across provinces. Equitable investment in education across provinces is compatible with both equity and efficiency goals in regional economic development.

Key words: human capital investment, regional economic development, rate of return to schooling, equity-efficiency trade-off, labor market segmentation.

Journal of Economic Literature classifications: I28, J42, R58.

Indonesia is a diverse country with uneven resource endowment across its provinces. Even though the country as a whole has grown rapidly over the past decades, regional economic performance has been mixed. The government has sought to promote more even regional development by a number of means, one of the principal ones being the distribution of central government revenues, known as the Inpres (*Instruksi Presiden*, or Presidential Order) grants, to provincial administrations. Azis (1992) found that the allocation of Inpres grants had a significant effect on the structural transformation of many provincial economies. However, previous research on regional investment strategies has focused almost entirely on the macro economic level, and said little about what kinds of investments are most efficient for a balanced regional economic development. This study examines the effects of human capital investment policies, particularly investment in education at the micro economic level, on the promotion of more equitable income growth across provinces. Although it is well established that human capital investment raises income, it is difficult to predict a priori whether education may increase or decrease regional economic inequities. On the one hand, national investment in education can promote more regional equity if it raises personal incomes in poor provinces relatively more than in rich provinces. On the other hand, if educated labor in poor provinces face a lack of appropriate employment opportunities and if labor is immobile, than human capital investment may do little to promote more balanced regional economic development.

Unfortunately, the economic databases at the provincial level for evaluating regional economic development policy are relatively weak. Therefore, detailed formal modeling of regional or provincial economies is not yet possible. Nevertheless, some studies of regional economic development have been conducted (Azis, 1992; Hill and Weidemann, 1989; Hill, 1992, 1996). These studies provide some evidence on the record of regional economic development in Indonesia. In this paper, information on regional economic indicators is used together with the results of the econometric analysis on the 1976 and 1989 Indonesian National Labor Force Survey (SAKERNAS) data to develop and test hypotheses regarding the contribution of investment in education to personal income growth in different regions in Indonesia. These results also suggest important aspects of labor market integration in Indonesia.

The first section of the paper summarizes the results of previous studies on regional economic development in Indonesia in the context of human capital investment. The second section examines educational investment and achievement at the provincial level. The third part presents estimates of the rate of return to education by province that are derived from the 1976 and 1989 SAKERNAS data.

The fourth section discusses some hypotheses on factors affecting regional differences in the rate of return to education and their implications on economic development policy in Indonesia. The final part summarizes the findings in this study and provides some policy implications.

To anticipate the major conclusions, the paper finds large differences in the rates of return to education among provinces with the highest rates of return in the poorest provinces, or in provinces where wages for un- or low-educated labor were the lowest. Thus, it appears that education not only enhances personal (and national) income, but also promotes greater equity across provinces. A model of segmented labor markets is advanced to explain why wage differences across provinces may exist, and some empirical support for this hypothesis is found.

Characterizing Regional Economic Development in Indonesia

Indonesia is the largest archipelagic nation in the world. The country includes 13,667 islands with five main ones which are Sumatera, Java, Kalimantan, Sulawesi, and Irian Jaya, two major archipelagos which are Nusa Tenggara and Maluku, and sixty smaller archipelagos (Hill 1992, 1996; Hill and Weidemann, 1989; Kuipers, 1993; Seekins, 1993).

Indonesia is also the fourth largest country in the world with an estimated population of around 200 million people. It is divided into 27 provinces. The most densely populated areas have been the islands of Java, Bali, and Madura which constituted only 7 percent of the total land area but carried more than 60 percent of the total population of the country. Population density in these islands was more than 500 per square kilometer while that of the most densely-populated outer islands was about one-fifth of this figure (see Table 1). It is predicted that by the year 2000 this country's population will be at least 210 million, with the majority being younger people (Hill 1992, 1996; Kuipers, 1993).

As a response to uneven population density, the government established the transmigration program which is a voluntary rural settlement arrangement that aims to move large numbers of people from densely populated areas to less populated islands. The majority of migrants in this program have moved to the other major islands or archipelagos outside of Java, Bali, and Madura. However, this program has not accounted for the majority of mobility across the country (Kuipers, 1993).

One distinguishing feature of the Indonesian economy in the mid 1970s up until the mid 1980s was the fact that incomes from oil and natural gas production constituted the bulk of export and government revenues. In the early 1980s oil and natural gas production constituted around three-quarters of the country's exports

and two-thirds of the government's receipts (Hill, 1992). However, the oil and natural gas industry is an enclave economy that has very little connection with the rest of the economy in a province. It is highly capital intensive and does not create much employment for the local labor. Backward and forward linkages to other sectors of the provincial economy are weak. Thus, it can be misleading to include oil and natural gas in a regional comparison of economic achievement.

At the regional level, Indonesia exhibits a considerable variation in both the level of economic development and the economic structure. Hill (1992) and Hill and Weidemann (1989) offered some regional groupings of the 27 provinces of Indonesia based on economic, demographic, and ecological characteristics (Table 2). Moreover, Hill (1992) also divided the 27 provinces into four categories based on real annual growth in per capita non-mining Gross Regional Product (GRP) and per capita non-mining GRP for the period of 1975-1984. Provinces whose growths in per capita non-mining GRP were lower than the national average were considered as provinces with low economic growth and those with below national average non-mining GRP were considered as provinces with low income. The first grouping does not necessarily coincide with the second one. One such example is Lampung which belonged to the densely populated group of provinces according to the first grouping, but was considered a low growth and low income province by the second one. Another example is Aceh which belonged to the resource rich as well as high growth and low income groups of provinces (see also Hill, 1996).

Historically, Java has been the most developed part of the country. Its share in the country's GDP in 1990 was 62 percent. Within Java itself, Jakarta and West Java have been the richest provinces with about one-third of the country's GDP excluding oil and more than one half of Java's non-oil gross regional production (GRP). A few provinces have fallen in the high income group of provinces precisely because they are oil-rich. Riau and East Kalimantan are such provinces whose GRPs were seven times the national average when mining was included but only two to three times the national average when it was not included for the period of 1975-1984 (Hill, 1992). Extreme poverty was concentrated in the eastern part of the country (Hill, 1996).

Regional Investment in Education

Educational policy has been one of the principal tools of the government to achieve broad national participation in the development of the country (Jones, 1994). Table 3 shows school enrollment ratios by level of education for each province in 1975 and 1989. The figures indicate the number of students per 1,000 people for primary, junior

high school, senior high school, and post secondary education. The figures show that before 1975 the emphasis of government educational policy had been placed on extending universal primary education. Since 1975, there has been a rapid growth in school enrollment, especially at the secondary and tertiary levels. This growth has been relatively equal across provinces.

School enrollment ratios in many off-Java provinces were higher than those in Java. In 1989, all provinces except Bali, South Kalimantan, and East Timor showed higher school enrollment ratios compared with the provinces in Java for primary schooling. For junior high school level, all provinces except Riau, West Nusa Tenggara, and South Kalimantan also showed higher enrollment ratios than the provinces in Java. Similarly, for senior high school level many off-Java provinces had higher enrollment ratios than those in Java. Compared with Java, Jambi, West and East Nusa Tenggara, Central and South Kalimantan, and East Timor were the provinces with lower enrollment ratios for senior high school level.

The high educational achievement at the primary and secondary levels of the off-Java provinces relative to that of the provinces in Java may have been the result of, first of all, the relatively young population and the catching-up effect following past neglect in the off-Java provinces (see also Hill, 1996). Second, opportunity costs of schooling may also have been relatively low in the off-Java provinces because the markets had not been able to generate sufficient demand for labor with these levels of education. Third, the educational system has been expanding rapidly throughout the country. This pattern of educational investment has made schooling more accessible to the general population at a lower cost. Studies have found that even as primary and secondary schooling has been made free in many countries, attendance has often been hindered by the relatively high out-of-pocket costs households have to pay. Transportation cost for the often enormous distance between schools and students' homes has been regarded as a significant portion of schooling costs, especially in rural areas. More schooling facilities may mean that more schools are available closer to students' homes, thus lower out-of-pocket costs for the average family.

For university level, the picture is somewhat different. Most off-Java provinces had lower university enrollment ratios compared with the Java provinces, except some provinces such as Aceh, North and West Sumatera, Bali, and North and South Sulawesi.

Rate of Return to Education by Province

The rate of return to education is estimated for every province using the standard Mincerian earnings function developed by Mincer

(1974). The model (see the appendix for its derivation) is the following:

$$\ln Y = a_1 + a_2S + a_3A + a_4A^2 \qquad (1)$$

where ln Y = the natural log of weekly earnings in Rupiah, S = years of schooling, and A = years of potential experience (individual's age - 6 - S). The intercept a_1 represents the natural log of earnings for individuals without any schooling or experience (when they first start working). The coefficient $a_2 = \partial \ln Y/\partial S$ gives the percentage change in Y, or the private marginal rate of return, for each additional year of schooling after having completed S years of schooling. This model assumes a constant rate of return to each additional year of schooling regardless of the level of schooling. The coefficient a_3 is the percentage increase in earnings, or the private marginal rate of return, for each additional year of working experience. Both a_2 and a_3 are expected to be positive. a_4 is expected to be negative to conform to the expected inverted-U shape of the experience-earnings profile, which means that the marginal rate of return to experience decreases over time and may eventually become negative.

To determine the expected rate of return to education in each province, data from the 1976 and 1989 SAKERNAS are used. Estimates of equation (1) are derived separately for each province using only observations from that province. Due to the limited number of observations, no distinction is made between genders or level of schooling. For this estimation, observations from Jakarta are combined with those from West Java, and observations from Yogyakarta are combined with those from Central Java. Jakarta and Yogyakarta are mostly urban provinces and thus differ in nature from the other provinces. Their economies are most closely linked to West Java and Central Java, respectively.

Another model is estimated that includes dummy variables for four levels of schooling (completed primary, junior high school, senior high school, and post high school education). The model looks like the following:

$$\ln Y = b_1 + \sum_i b_{2i}L_i + b_3A + b_4A^2 \qquad (2)$$

where the summation is over i levels of schooling and L_i is a dummy variable for the i^{th} level of schooling (no schooling is the reference level of schooling against which the other levels are compared). Unlike the first model, this model allows the marginal rate of return to education to differ for different levels of education. For example, suppose that it takes three years to complete junior high school education for someone with completed elementary education. The marginal rate of return to junior high school education is the coefficient of the dummy variable for this level of education divided by three.

There are, however, insufficient observations to obtain robust estimates of this model at the provincial level. Thus, this model is

applied at a regional level based on the major island or island groups of Indonesia: Sumatera, Java, Kalimantan, Sulawesi, Nusa Tenggara (including Bali), and East Indonesia (Irian Jaya and Maluku). This model is also estimated using the 1976 and 1989 SAKERNAS data.

The Heckman two-stage procedure is used in this study (Heckman, 1976). The first stage models the decision to participate in the wage labor market. The second stage estimates the Mincerian earnings function (Mincer, 1974) to establish the correlation between individual earnings and education, conditional on wage labor market participation. This procedure corrects for sample selectivity bias and is needed because only individuals whose earnings are reported (i.e., those in the wage labor market) can be used in the estimation of the earnings function.

A note should be given to the decision to group Bali and the Nusa Tenggara provinces into the same major island group. In general, Bali is more economically developed, more densely populated, and more integrated with the rest of the Indonesian economy due to better infrastructure than the Nusa Tenggara provinces. However, with respect to social and economic variables of interest in the present analysis, Bali and the Nusa Tenggara provinces appeared to be similar. These measures indicate that Bali had closer resemblance with the provinces in the Nusa Tenggara archipelago than with the Java provinces. For example, this is apparent in government expenditure at the provincial level in 1985 and foreign investment in provinces accumulated between 1967 and 1985 (Table 4), earnings for uneducated labor in 1976 (Table 5), and earnings for uneducated labor and the rate of return to education in 1989 (Table 7). However, it is also true that a few other measures of social and economic variables indicate that Bali more closely resembled the Java provinces. School enrollments per 1,000 population for different levels of schooling in these provinces in 1975 and 1989 (Table 3) are one such example. On the whole, the grouping of Bali and the Nusa Tenggara provinces into the same major island grouping seems to be justifiable.

In this study, private and not social rates of return to education are estimated. The social rates of return, which would include government subsidies for education in addition to the private cost of forgone earnings while in school, are generally lower than the private rates of return to schooling (Psacharopoulos and Woodhall, 1985). Estimates of the social rate of return to schooling are not presented in this paper due to a lack of provincial-level data on the cost of education. However, if government subsidies for education were the same per pupil across provinces, then the social rate of return would be proportionally lower than the private rate of return to education in each province. Using national-level estimates for Indonesia, Kawuryan (1997) found that the social rate of return was 1 percent to 3 percent lower than the private rate of return to education depending upon

gender and level of schooling. Rough estimates of the social rate of return to schooling at the provincial level can be based on this result.

Table 5 presents the rate of return to education by province for the 1976 data using model 1. The rate of return to education at the provincial level varied a great deal, ranging from a low of 3.81 percent in East Kalimantan to a high of 18.35 percent in East Nusa Tenggara. Some provinces in Sumatera, all of the provinces in Java, and also the provinces of Bali, West Nusa Tenggara, North and Southeast Sulawesi had at least 10 percent rates of return to education. The rates of return to education were below 10 percent for all of the provinces in Kalimantan, several provinces in Sumatera, and also for the provinces of Central and South Sulawesi, Maluku, and Irian Jaya.

Estimates of the rate of return to education for the 1976 data from the level of schooling model, or model 2, for the regional groupings are shown in Table 6. These estimates present a somewhat different picture. At the regional level, the highest rates of return were obtained in Sulawesi for all levels of schooling, followed by Java. The rates of return to schooling in Sumatera, Kalimantan, Nusa Tenggara, and the eastern part of the country were uniformly low (around 8 percent or lower for all levels of schooling).

In 1989, the rates of return to education in most of the Sumatera and Sulawesi provinces, and the provinces of Bali, West and East Nusa Tenggara decreased while those in the Java and Kalimantan provinces, and the provinces of Maluku and Irian Jaya increased compared with 1976 (Table 7). In 1989 there also seemed to be a strong correlation between low wages for unskilled labor (measured by $\ln W_0$ or a_1 in model 1) and high rates of return to education. For example, in Java the rate of return to education was at least 12.86 percent for each province while $\ln W_0$ was below 8.10. In Kalimantan, the rate of return to education was no more than 7.72 percent while $\ln W_0$ was at least 8.56 and as high as 8.93 in East Kalimantan. This implies that inter-provincial wage differentials were greater for un- or low-educated workers compared with more highly educated workers. Thus, relatively higher wage gains due to education were achieved in provinces with the lowest wages for unskilled labor, i.e., where the opportunity cost to schooling was relatively low.

The correlation between low wages for unskilled labor and high rates of return for each level of schooling from the regional groupings is also observed for the 1989 data (Table 8). These results also show that at the regional level, higher levels of schooling generally had higher rates of return.

The wide variation in the estimates of the rate of return to schooling probably reflects the differences in the levels of economic development across provinces that was described above. In addition, it suggests barriers to mobility that might otherwise equalize wages across provinces. The paper addresses this issue in the next section.

Factors Affecting Regional Differences in Returns to Education

In this section, the reasons why the rates of return to education differ across provinces are explored in more detail. Differences in the rate of return to education mean that wage rates differ among provinces for educated or uneducated labor, or both. If these inter-provincial wage differences persist for a long time, it may imply regionally segmented labor markets, i.e., social, cultural, and economic factors restrict the movement of the labor force among provinces such that real wage rates are not equalized (see also Cain, 1976).

The issue can be conceptualized with the following descriptive model. First, assume that one can divide the labor force into two groups, educated and uneducated workers. The wage of each group is determined by the demand and supply conditions facing each group, and the difference in wages between the two groups is the (private) rate of return to education (see Figure 1). A larger pool or supply of uneducated labor (S_1) decreases wage for this group and thus raises the rate of return to education in a province. An increase in the demand for uneducated labor (D_1) raises the wage of unskilled labor, and thus lowers the rate of return to education. On the other hand, an increase in the supply of educated labor (S_2) decreases the wage of this group and thus decreases the rate of return to education while an increase in the demand for educated labor (D_2) increases the wage of this group and thus increases the rate of return to education.

Based on this simple model, some variables are constructed to represent the supply and demand conditions for educated and uneducated labor and these variables are regressed against the provincial estimates of the rate of return to education. The size of population in a province is used as a measure of the supply of uneducated or unskilled labor, while the amount of land in a province is used as a measure of the demand for unskilled labor. The latter is based on the premise that unskilled labor is mostly engaged in land intensive activities such as agriculture and. forestry. Therefore, an increase in the supply of land increases the demand for uneducated workers. The supply of and the demand for uneducated labor in a province can thus be measured by population density in that province. An increase in population density is caused either by a decrease in the amount of land or an increase in the number of population. Thus, an increase in population density would be expected to reduce real wage of uneducated workers relative to the real wage of educated workers and therefore increase the rate of return to education.

The supply of educated labor can be measured by past investment in education in a province, especially those at the high

school level and above. Ideally, the cumulative number of senior high school graduates in a province over the preceding four decades would be a good measure of the provincial supply of educated labor. Assuming that in 1989 people with senior high school education started working when they were 18 and continued working until they were 60 years old, human capital stock in 1989 should have been the result of its accumulation in the past 42 years. In other words, the number of senior high school graduates accumulated in the 42 years leading to 1989,constituted the educated labor in 1989. Limitations of data do not allow the use of this ideal measure and in its place senior high school enrollment ratio in 1975 is used as a "snapshot" measure of educated labor in 1989 as shown in Table 3. A higher school enrollment ratio increases the supply of educated workers in a province and is expected to lower wages for this group, thus decreasing the rate of return to education. Normally, school enrollment ratio is defined as the ratio between the number of students at a particular level of schooling and the size of the population within the relevant age group. In this analysis, school enrollment ratio is calculated as the ratio of students at a particular level of schooling per 1,000 population due to lack of data on population size for different age groups. This will have no consequence in the regression analysis as long as the proportion of school age population to the total population is roughly the same in each province. This is found to be the case based on analysis of the SAKERNAS data.

One measure of the demand for educated labor is the stock of modern physical capital investment. A larger stock of physical capital in modern manufacturing and service industries increases the demand for educated or skilled labor and thus raises the wage for this group. Physical capital stock is a better measure of the demand for educated labor than regional economic output or income because the latter variables are not exogenous, i.e., a high provincial GDP could either be a cause or a result of high returns to education. In this study, modern physical capital stock is measured by the stock of foreign physical capital investment in the non-oil and natural gas sectors as reported by Hill (1992). Foreign investment in the oil and natural gas sector is excluded because, as discussed previously, employment generated by these large investments is low and this sector also develops few linkages with the local economies. Foreign physical capital rather than domestic physical capital is used because foreign physical capital is likely to be associated with more modern technology requiring a more educated work force to operate (Peterson, 1989).

The model regresses the natural log of provincial rates of return to education in 1989 resulted from model 1 as a function of the natural log of population density (from the 1990 census), the natural log of high school enrollment per 1,000 people in the province for

1975, and the natural log of per capita cumulative foreign non-oil and natural gas investments between 1968 and 1985 measured in U.S. dollars. This particular functional form is found to have a better fit to the data compared with linear or log-linear functional forms. This functional form also has the advantage that the coefficients can be directly interpreted as elasticities. Annual investment is discounted by the GDP deflator and then summed over this period. It is assumed that physical capital stock produces a constant stream of services over a lifetime of 20 years, or a one hoss-shay value (Peterson, 1989). Unfortunately, data on foreign physical capital investments at the provincial level for the years between 1986 and 1988 are not available for the present study. Also note that the data are for approved foreign physical capital investments which may in some cases overstate the actual investments (Hill, 1992).

The results of this estimation are shown in Table 9. The regression is statistically significant (the F statistic is significant at 1 percent level of significance) and the R^2 is 40 percent. All of the variables have the expected signs. At the variable mean, every 1 percent increase in population density increased the rate of return to schooling in a province by 0.13 percent. This was most likely because a large population relative to land resources pushed the real wages down for un- or low-educated labor, thereby reducing the opportunity cost of schooling. This result seems to suggest that there were regional barriers to labor migration among this class of labor preventing equalization of their wages across provinces. The evidence on regional labor market segmentation for more educated labor is not as clear. The coefficient of the natural log of senior high school enrollment ratio is borderline statistically significant at the 5 percent level of significance. An increase by 1 percent in the number of senior high school students per 1,000 population reduced the rate of return to education by 0.32 percent. This may be because an increase in the supply of educated labor reduces wage for this group. The stock of foreign capital was positively related to the rate of return to education, although this relationship is not statistically significant. The borderline statistical significance for senior high school enrollment and the lack of statistical significance for foreign physical capital investment variables suggest that barriers to labor mobility among educated labor may have been less or diminishing compared with those among un- or low-educated labor. Recall that the rate of return to education is determined by the difference in wages between un- or low-educated labor and educated labor. The combination of good statistical significance for measures of the supply of and the demand for un- or low-educated labor and the mixed results for measures of the supply of and the demand for educated labor may indicate that differences in inter-provincial rates of return to schooling were less influenced by inter-provincial differences in the wages of educated labor than by

inter-provincial differences in the wages of un- or low-educated labor. This, in turn, may indicate that social, cultural, and economic barriers to mobility for un- or low-educated labor may have been significant while those for educated labor may have been relatively less significant. The mixed results for measures of the supply of and the demand for educated labor may also indicate that these measures do not adequately represent the supply and demand conditions for educated labor. For example, if public sector employment is relatively important for this group, wages are more likely to be administratively determined and less influenced by market forces. In addition, foreign physical capital investment may not fully capture the demand for educated labor. Unfortunately, accurate measures of modern capital investment at the provincial level in Indonesia are not yet available.

Conclusions

Investing in human capital in poor provinces appears to support more balanced growth in incomes across provinces in Indonesia. Using the 1976 and 1989 SAKERNAS data to estimate the rate of return to education in each province and region (based on major island grouping) of the country, education is found to have the highest returns in the poorest provinces. Education helped to close the gap in regional income disparity. The private costs of school attendance were also lower in the poorest provinces, given the low opportunity cost of labor. These factors explain the relatively high rate of return to education estimated for these provinces.

The empirical estimates reveal a wide range in the rates of return to education across provinces. In 1976, estimates ranged from 3.81 percent in East Kalimantan to 18.35 percent in East Nusa Tenggara. The rate of return to schooling was equal to or above 10 percent for some provinces in Sumatera, all provinces in Java, and also the provinces of Bali, West Nusa Tenggara, and North and Southeast Sulawesi. It was less than 10 percent in all provinces in Kalimantan, several provinces in Sumatera, and also the provinces of Central and South Sulawesi, Maluku, and Irian Jaya. In 1989, estimates ranged from 4.72 percent in East Kalimantan to 13.80 percent in East Nusa Tenggara. All provinces in Java, Nusa Tenggara, and the provinces of Bali, Central Sulawesi, and Irian Jaya had rates of return to schooling over 10 percent. Rates of return to schooling were the lowest in Kalimantan, averaging only 5.52 percent across its provinces. The rates of return for the provinces in Sumatera and Sulawesi fell between 7 percent and 10 percent in most cases.

The wide range in the rates of return to education reflects the great diversity in economic development and structure across provinces of Indonesia. Furthermore, the differences in the estimated rates of return to education across provinces are generally consistent

with the model of regionally segmented labor markets. This model assumes that significant social, cultural, and economic barriers to regional labor mobility prevent wage equalization across provinces. The estimates also suggest that labor market segmentation was more pronounced for un- or low-educated workers. In other words, regional differences in wages were greater among un- or low-educated workers than for educated workers. One possibility is that education increased labor mobility across provinces, thereby reducing regional wage differences for this class of labor. Overall, however, the multiple regression model explains only 40 percent of the variation in the rates of return to education across provinces. Other factors undoubtedly also contributed to the differences in the provincial rates of return to schooling. Identifying these other factors is a topic for future research.

The evidence shows that education has a progressive effect on regional economic development. It may reduce regional market segmentation. More educated workers may be somewhat better able to compete for jobs in other provinces because they possess the needed language and market skills. This reduces inter-provincial earnings differences for this group of workers. Furthermore, the estimation results suggest that equitable investment in education across provinces is compatible with both equity and efficiency goals since the highest rates of return were achieved in the poorest provinces.

Appendix

Table 1: Area, Population, and Density by Province

Province	Area (sq. kilometer)	Population ('000) 1980	1990	Density (per sq. kilometer) 1980	1990
Aceh	55,392	2,611	3,416	47	62
North Sumatera	70,787	8,361	10,256	118	145
West Sumatera	49,778	3,407	3,999	68	80
Riau	94,561	2,169	3,306	23	35
Jambi	44,800	1,446	2,016	32	45
South Sumatera	103,688	4,630	6,277	45	61
Bengkulu	21,168	768	1,179	36	56
Lampung	33,307	4,625	6,006	139	180
Sumatera	473,481	28,017	36,455	59	77
West Java and Jakarta	46,890	33,957	43,635	724	931
Central Java and Yogyakarta	37,375	28,124	31,435	752	841
East Java	47,921	29,373	32,504	613	678
Java	132,186	91,454	107,574	692	814
Bali	5,561	2,470	2,778	444	500
West Nusa Tenggara	20,177	2,725	3,370	135	167
East Nusa Tenggara	47,876	2,737	3,269	57	68
Nusa Tenggara and Bali	73,614	7,932	9,417	108	128

West Kalimantan	146,760	2,486	3,239	17	22
Central Kalimantan	152,600	954	1,396	6	9
South Kalimantan	37,660	2,065	2,598	55	69
East Kalimantan	202,440	1,218	1,877	6	9
Kalimantan	539,460	6,723	9,110	12	17
North Sulawesi	19,023	2,115	2,479	111	130
Central Sulawesi	69,726	1,290	1,711	19	25
South Sulawesi	72,781	6,062	6,982	83	96
Southeast Sulawesi	27,686	942	1,350	34	49
Sulawesi	189,216	10,409	12,522	55	66
Maluku	74,505	1,441	1,856	19	25
Irian Jaya	421,981	1,174	1,641	3	4
East Indonesia	496,486	2,615	3,497	5	7
East Timor	14,874	555	748	37	50
Indonesia	1,919,317	147,490	179,379	77	93

Source: BPS, Statistical Yearbook of Indonesia, various issues.

Table 2: Regional Development in Indonesia

Province	Economic characteristics	GDP in 1983 (billion Rp)	GDP growth rate (1975-84 annual avg.)
Lampung	densely populated	999.2	0.5%
West Java and Jakarta	densely populated	16,378.4	6.9%
Central Java and Yogyakarta	densely populated	7,454.0	6.2%
East Java	densely populated	10,347.8	6.9%
Bali	densely populated	904.9	10.2%
West Nusa Tenggara	isolated	525.4	5.4%
East Nusa Tenggara	isolated	509.7	5.9%
East Timor	isolated	n.a.	n.a.
Aceh	resource rich	3,470.5	15.9%
Riau	resource rich	1,251.6	-6.8%
Jambi	resource rich	432.8	2.4%
East Kalimantan	resource rich	3,880.3	9.6%
Irian Jaya	resource rich	892.4	-0.7%
North Sumatera	settled outer island	3,645.7	5.0%
West Sumatera	settled outer island	8,687.9	9.0%
South Sumatera	settled outer island	3,189.1	4.5%
South Kalimantan	settled outer island	842.1	5.0%
North Sulawesi	settled outer island	715.3	5.3%
South Sulawesi	settled outer island	1,684.5	5.2%
Bengkulu	sparsely settled	236.2	9.4%
West Kalimantan	sparsely settled	759.9	5.4%
Central Kalimantan	sparsely settled	483.6	7.5%
Central Sulawesi	sparsely settled	341.0	4.7%
Southeast Sulawesi	sparsely settled	315.1	5.3%
Maluku	sparsely settled	536.1	4.7%
Indonesia		68,483.5	5.8%

Sources: Hill and Weidemann, 1989; Hill, 1992.

Table 3: School Enrollment by Province, 1975 and 1989

	Students per 1,000 persons						
	1975			1989			
Province	Primary	Junior HS	Senior HS	Primary	Junior HS	Senior HS	Univ
Aceh	93	12	3	157	36	23	10
North Sumatera	134	21	7	182	49	33	11
West Sumatera	138	11	5	174	40	30	12
Riau	111	11	3	161	29	19	4
Jambi	104	9	2	172	30	18	4
South Sumatera	127	14	5	173	35	22	5
Bengkulu	126	12	3	208	40	23	6
Lampung	110	8	2	194	36	20	4
Sumatera	123	14	5	178	39	25	8
West Java and Jakarta	102	11	4	135	28	19	10
Central Java and Yogyakarta	108	11	4	143	30	20	7
East Java	94	10	3	120	28	20	8
Java	101	11	4	133	28	20	9
Bali	111	15	4	137	48	41	13
West Nusa Tenggara	81	7	1	153	23	16	6
East Nusa Tenggara	143	12	3	179	32	16	4
Nusa Tenggara and Bali	112	11	3	157	33	23	8
West Kalimantan	92	10	3	171	34	19	5
Central Kalimantan	134	16	3	198	34	18	4
South Kalimantan	90	8	3	141	25	18	6
East Kalimantan	141	16	5	179	40	25	7
Kalimantan	104	11	3	168	33	20	5
North Sulawesi	166	20	5	154	43	29	12
Central Sulawesi	159	12	3	181	35	20	6
South Sulawesi	108	9	3	164	39	25	13
Southeast Sulawesi	130	11	3	181	44	25	6
Sulawesi	127	12	4	166	40	25	11
Maluku	82	15	5	182	44	21	6
Irian Jaya	126	11	2	155	34	19	5
East Indonesia	102	13	3	169	39	20	6

Indonesia	108	11	4	148	32	21	8

Source: BPS, Statistical Yearbook of Indonesia (various issues).

Table 4: Government Expenditures and Foreign Investment by Province

Province	Gov. Inpres Grants (Rp/capita, 1985)	Share	Foreign investment ($/capita, 1967-85)	Share
Aceh	15,605	3.4%	41	3.0%
North Sumatera	9,841	6.4%	156	33.9%
West Sumatera	14,121	3.6%	5	0.4%
Riau	15,025	3.1%	15	1.0%
Jambi	16,534	2.1%	2	0.1%
South Sumatera	10,328	4.1%	5	0.7%
Bengkulu	25,953	1.9%	3	0.1%
Lampung	6,930	2.6%	8	1.0%
Sumatera	11,816	27.2%	52	40.1%
West Java and Jakarta	5,100	14.1%	47	43.1%
Central Java and Yogyakarta	6,022	12.0%	6	3.8%
East Java	5,193	10.7%	6	4.4%
Java	5,398	36.7%	23	51.3%
Bali	10,004	1.8%	4	0.2%
West Nusa Tenggara	12,959	2.8%	0	0.0%
East Nusa Tenggara	13,526	2.8%	0	0.0%
Nusa Tenggara and Bali	12,284	7.3%	1	0.3%
West Kalimantan	16,407	3.4%	2	0.1%
Central Kalimantan	32,005	2.8%	38	1.1%
South Kalimantan	13,210	2.2%	20	1.1%
East Kalimantan	19,662	2.3%	38	1.5%
Kalimantan	18,556	10.7%	20	3.8%
North Sulawesi	14,406	2.3%	6	0.3%
Central Sulawesi	32,005	3.5%	1	0.0%
South Sulawesi	10,475	4.6%	1	0.2%
Southeast Sulawesi	12,915	1.1%	5	0.1%
Sulawesi	14,458	11.4%	3	0.7%
Maluku	19,884	2.3%	1	0.0%
Irian Jaya	23,259	2.4%	108	3.7%
East Indonesia	21,468	4.7%	51	3.8%
East Timor	38,749	1.8%	0	0.0%
Indonesia	8,815	100.0%	26	100.0%

Foreign investments exclude oil, gas, banking, and insurance sectors (see text).

Source: Hill and Weidemann, 1989, Table 1.13, and Table 1.15.

Table 5: Rate of Return to Education by Province, 1976

Province	ln(Wo)	ROR
Aceh	6.368	12.62%
North Sumatera	8.093	5.06%
West Sumatera	7.560	7.91%
Riau	7.822	10.57%
Jambi	7.290	10.05%
South Sumatera	7.144	9.04%
Bengkulu	7.172	9.03%
Lampung	7.142	6.34%
Sumatera	7.612	8.20%
West Java and Jakarta	8.004	10.69%
Central Java and Yogyakarta	7.376	10.96%
East Java	7.021	13.06%
Java	7.483	11.90%
Bali	6.696	11.91%
West Nusa Tenggara	6.375	15.42%
East Nusa Tenggara	5.992	18.35%
Nusa Tenggara and Bali	6.621	13.20%
West Kalimantan	8.397	4.21%
Central Kalimantan	7.735	5.11%
South Kalimantan	7.250	6.22%
East Kalimantan	8.117	3.81%
Kalimantan	7.899	4.82%
North Sulawesi	7.387	9.98%
Central Sulawesi	7.871	5.66%
South Sulawesi	6.951	9.58%
Southeast Sulawesi	6.408	13.00%
Sulawesi	7.227	9.41%
Maluku	7.646	6.97%
Irian Jaya	7.604	9.52%
East Indonesia	7.827	7.49%

ROR = marginal rate of return to schooling

Table 6: Rate of Return to Level of Schooling by Region, 1976

Region	ln(Wo)	Primary	Junior HS	Senior HS	Post HS
Sumatera	7.951	5.36%	6.03%	5.23%	8.05%

Java	8.015	8.96%	9.89%	8.02%	9.44%
Sulawesi	7.273	9.26%	10.86%	9.19%	9.88%
Kalimantan	8.320	4.44%	3.64%	2.21%	3.54%
Nusa Tenggara	7.719	7.49%	7.63%	6.31%	6.97%
East Indonesia	8.001	4.70%	6.19%	5.74%	7.27%

Table 7: Rate of Return to Education by Province, 1989

Province	ln(Wo)	ROR
Aceh	8.715	7.02%
North Sumatera	8.367	7.46%
West Sumatera	8.410	7.15%
Riau	8.799	5.78%
Jambi	7.957	9.39%
South Sumatera	8.278	8.06%
Bengkulu	8.262	6.95%
Lampung	8.203	7.77%
Sumatera	8.392	7.59%
West Java and Jakarta	8.072	12.91%
Central Java and Yogyakarta	7.617	12.86%
East Java	7.551	13.31%
Java	7.747	13.39%
Bali	8.148	10.35%
West Nusa Tenggara	7.696	11.27%
East Nusa Tenggara	7.472	13.80%
Nusa Tenggara and Bali	7.952	11.25%
West Kalimantan	8.681	5.79%
Central Kalimantan	8.648	5.11%
South Kalimantan	8.560	7.72%
East Kalimantan	8.928	4.72%
Kalimantan	8.752	5.52%
North Sulawesi	8.260	8.86%
Central Sulawesi	8.074	10.24%
South Sulawesi	8.208	9.41%
Southeast Sulawesi	8.521	7.69%
Sulawesi	8.264	8.98%
Maluku	8.421	7.11%
Irian Jaya	8.236	13.24%
East Indonesia	8.214	9.85%

ROR = marginal rate of return to schooling

Table 8: Rate of Return to Level of Schooling by Region, 1989

Region	ln(Wo)	Primary	Junior HS	Senior HS	Post HS
Sumatera	8.607	3.54%	5.82%	5.68%	6.28%
Java	8.023	8.73%	10.63%	10.57%	11.82%
Sulawesi	8.581	2.95%	5.33%	6.19%	7.17%
Kalimantan	8.954	1.29%	3.54%	3.66%	4.69%
Nusa Tenggara	8.211	6.71%	8.29%	9.00%	10.05%
East Indonesia	8.446	6.87%	6.98%	8.09%	8.08%

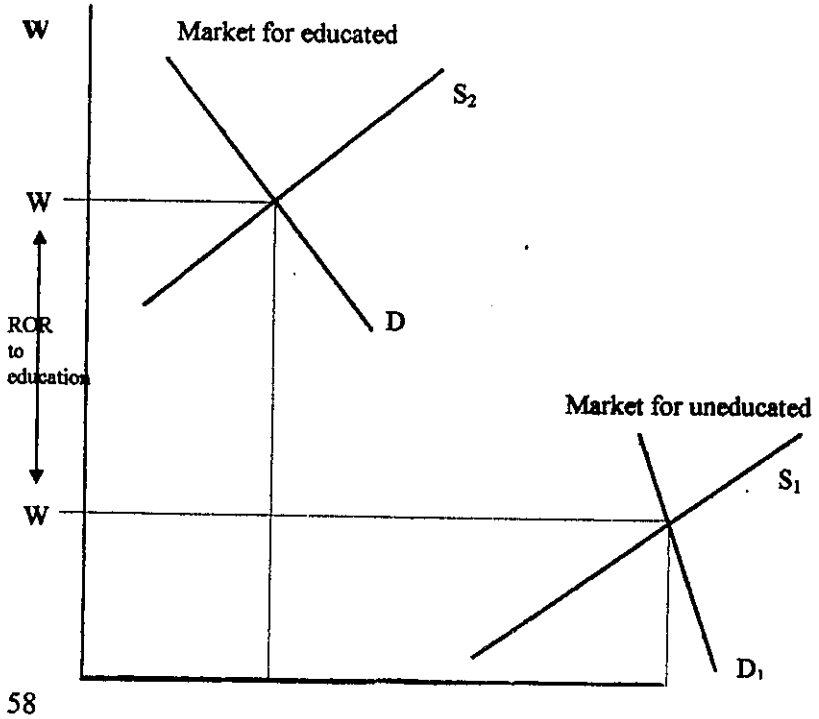
Table 9: Factors Affecting Provincial Rate of Return to Education in 1989

Dependent variable: ln(provincial rate of return to education in %) mean = 2.188

	coefficients	standard error	t-statistic	Mean
Intercept	1.900	0.231	8.218	
ln(population density, 1990)	0.128	0.039	3.303	4.278
ln(senior HS students/1000 population, 1975)	-0.317	0.154	-2.054	1.347
ln($/capita of foreign investment, 1968-85)	0.027	0.033	0.827	2.661
No. of observations = 24		F statistic		4.527
$R^2 = 0.404$		Significance of F		0.014

Source of data: population density from BPS, Statistical Yearbook of Indonesia, 1990. Senior high school enrollment for 1975: BPS, Statistical Yearbook of Indonesia, 1976. Foreign non-oil and natural gas capital investment from Hill, 1992.

Figure 1: Supply of and Demand for Educated and Uneducated Labor



Derivation of the Mincerian Earnings Function

Mincer (1974) developed a model to measure the rate of return to education. In this model, an individual is assumed to choose the level of schooling that will maximize the present value of lifetime earnings, given a personal discount rate. Mincer (1974) considered only the costs and benefits to the individual such that the model provides an estimate of the private rate of return to education. The model assumes that the only cost of schooling is forgone earnings while in school. Out-of-pocket costs are considered to be trivial, although adjustments can be made for their inclusion. Most applications of the Mincerian earnings function do not include out-of-pocket costs partly due to data limitations.

The derivation of the Mincerian earnings model is as follows. Let the present value of lifetime earnings without education be:

$$V(0) = \int_0^T e^{-rt} W_0 \, dt \qquad 1$$

and the present value of earnings with S years of schooling be:

$$V(S) = \int_S^{T+S} e^{-rt} W_S \, dt \qquad 2$$

W_0 and W_s are future earnings without and with education, which are assumed to be constant throughout the lifecycle. An individual's discount rate is given by r. It is assumed that $V'(S) > 0$ and $V''(S) < 0$, or that there are diminishing marginal benefits from schooling. Furthermore, it is assumed that an individual works T periods whether or not he or she obtains education. In other words, with no education an individual works from period 0 to T, and with S years of education, he or she works from period S to T + S. Finally, it is assumed that an individual chooses $S \geq 0$ years of schooling in order to maximize V(S) and that all individuals in the economy are identical in that they have the same ability, the same access to the market, and full information about the returns to schooling.

Given these assumptions, a market equilibrium condition is achieved when V(0) = V(S). This implies that in equilibrium individuals are indifferent between levels of schooling and one can therefore expect to observe individuals who choose different levels of schooling. To see that this is an equilibrium condition, suppose for some $S > 0$, $V(S) > V(0)$. Then individuals with $S = 0$ can increase their wealth by choosing $S > 0$. As these individuals increase their schooling, the supply of educated workers will increase and W_s will fall, and the supply of uneducated workers will decrease and W_0 will

rise, until the condition V(S) = V(0) is restored. Or, suppose for some individuals with education S > 0, V(S) < V(0). Then these individuals can do better by choosing less or no schooling. As this group of

$$\int_0^T e^{-rt} W_0 \, dt = \int_S^{T+S} e^{-rt} W_S \, dt \qquad 3$$

individuals reduces its demand for education, wages will adjust in a similar way until V(0) = V(S). When V(0) = V(S), individuals at all levels of schooling will be maximizing wealth and no more and no less schooling will be demanded.

Letting V(0) = V(S), one obtains:

Since W_0 and W_s are constants, these terms can be moved outside the

$$\frac{W_s}{W_0} = \frac{\int_0^T e^{-rt} dt}{\int_S^{T+S} e^{-rt} dt} \qquad 4$$

integrals. Then, by rearranging terms one obtains:

Solving the integrals yields:

$$\frac{W_s}{W_0} = \frac{e^{rT} - 1}{e^{rS}(e^{rT} - 1)} = e^{rS} \qquad 5$$

Taking the natural logarithm (ln) of both sides and solving for ln W_s, one obtains:

$$\ln(W_s) = \ln(W_0) + rS \qquad 6$$

In equation 6, the natural log of current earnings is expressed as a function of a constant term ($\ln W_0$) and years of schooling (S), where the coefficient on the schooling variable is the rate of return to education. Earnings can also be allowed to vary by age or employment experience by adding to equation 6 an individual's age A which reflects years of working experience. Since lifetime wage patterns typically follow an inverted-U shape, it is common to add both linear and quadratic forms for age or working experience to obtain:

$$\ln Y = b_0 + b_1 S + b_2 A + b_3 A^2 \qquad 7$$

where ln Y = ln W_s = natural log of present earnings or wages;

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S = years of schooling;
A = age or years of working experience;
b_0 = ln W_0 = natural log of wage without education;
b_1 = r = (private) rate of return to education; and
b_2 and b_3 give the rate of return to working experience.

Equation 7 is known as the Mincerian earnings function.

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