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JOB COMPETITION VERSUS HUMAN CAPITAL IN ESTIMATING RETURNS TO EDUCATION.

S.I. Cohen *

Abstract: The paper relies on certain elements of the job competition model (JC) in formulating an alternative to the conventional approach of human capital (HC) for measuring returns to education. The paper applies both approaches and compares results for Indonesia and Pakistan. Returns to education following JC are found to be systematically lower than following HC.

1. Introduction

Conventional methods for estimating returns to education rely on human capital theory (HC) which equates earnings to the marginal productivity of the worker and explains the latter in terms of the education attained by the worker.

Job competition theory (Thurow 1969), which is equally legitimate in many contexts (Versluis 1978), downgrades the impact of education and assigns, instead, a primary role for occupations in determining wages. Job competition theory (JC), asserts that it is the marginal productivity of the job, or the occupation, which determines the wage rate to which a worker will be matched. Wages are paid on the basis of the characteristics of a job or an occupation. Occupations differ in their intensities of using capital, handling information, and practising leadership. More demanding occupations are paid higher wages. Productivity is considered to be an attribute of occupations.

In the job competition model workers are matched to occupations by certain worker characteristics which may well be identifiable with educational characteristics as well as other background characteristics. The familiar cross-tabulation between occupations and educations can be interpreted as the result of such a matching process.

While in the HC model education has a direct link with productivity and wage, in the JC model the role of education in influencing wages is indirect and secondary; namely via occupational upgrading. More education gives access to better occupations with higher pay. Investment in schooling by students and

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* Erasmus University Rotterdam, Postbus 1738, 3000 DR Rotterdam.

expected wages are linked in the JC model by the expectations of an occupational upgrading, and hence, a higher occupational wage. For employers, the educational certificates can serve as a screening device in the selection process.

This paper relies on certain elements of the JC model in formulating an alternative to the HC model for measuring returns to education. The paper applies both approaches under simplified assumptions and compares the results in the context of two countries: Indonesia and Pakistan, and comments on problems of validation and integration of both approaches.

2. The HC- versus JC-approach

Conventionally, the rate of return to investment in educational level i, r_i, is based on HC theory, and can be directly estimated from earning functions or indirectly by employing age-earnings profiles by educational levels to estimate future benefits and finding the discount rate which equates costs to benefits. Under simplified assumptions of all earnings explainable by education, a constant stream of benefits, foregone earnings incurred in the first year, and no schooling costs, the rate of return to the individual pursuing education can be simply obtained as a benefit cost ratio as in the short-cut of eq. 1. For a discussion of HC approaches see Psacharopoulos (1980) and Cohen (1985).

$$(W_i - W_{i-1}) / E_i \, W^f_{i-1} = r_i \qquad (1)$$

where W_i = annual earnings of workers with completed educational level i
W^f_{i-1} = initial earnings of workers who forego educational level i
E_i = number of foregone years of earning during educational course i

If W^f_{i-1} can be expressed as y W_i where y is a ratio relating the initial wage of starting workers to the average wage of workers of all ages, eq. 1 can be simplified further in eq. 2.

$$(W_i - W_{i-1}) / E_i \, y \, W_{i-1} = r_i \qquad (2)$$

In the JC theory, as will be operationalised in eq. 3, wage by occupation j, W_j, is the focus; in contrast to HC theory where wage by education i, W_i,

is the focus.

In the JC theory, wages are coupled to occupations in a manner which reflects the relative productivities of different occupations. More productive occupations are remunerated with higher wages. Wage formation is assumed to be more dependent on the specifics of the job and less on the personal characteristics of the particular job holder.

According to JC theory, for a given occupation the average wage can be assumed to be a well representative indicator of individual earnings, as compared to where other units of analysis than occupation are considered. In general, the difference between the actual wage obtained by a worker in a particular occupation and the average for that occupation is due to age and other personal characteristics of the worker such as sex, status, education, etc. With the exception of age, which determines seniority in pay scales, other personal characteristics tend to associate with particular occupations. As a result, differences between individual and average wages in an occupation tend to be relatively moderate. There is, therefore, in a JC approach less need to correct for variance in earnings due to personal characteristics. In contrast, HC approaches may require more strictly the separation of earning effects of educational from other personal characteristics. Whatever the case may be, it is noted that the earning effects of personal characteristics have been ignored for the moment in our operationalization of both the JC and HC approaches.

The impact of additional education on enhanced earnings is incorporated in the JC approach in an indirect way: by considering more education to give access to an upgraded occupational mix with higher labour productivities and earnings.

The internal rate of return to the individual of pursuing education, i, v_i, can be expressed as in eq. 3.

$$\sum_{t=1}^{N_i} \sum_{j} (s_{ji,t}W_{j,t} - s_{ji-1,t}W_{j,t})(1+v_i)^{-t} = \sum_{t=1}^{E_i} \sum_{j} (s_{ji-1,t}W^f_{j,t})(1+v_i)^{t} \qquad (3)$$

where s_{ji} = proportion of the labour force with education i in occupation j
W_j = mean earnings of occupation j
W^f_j = initial earnings of occupation j
E_i = foregone years of earning during educational course i
N_i = number of working years after completing education i.

The left-hand terms give the discounted net benefits over the working years while the right-hand terms give discounted foregone earnings during the educational course. Eq. 3 allows for variable occupational wages over time and for changing compositions over time of the occupational-educational matrix of which s_{ji} are elements. Changing compositions over time in the present context are equivalent to occupational mobility.

If the yearly benefits are assumed to occur at a constant rate, all foregone earnings are counted as if they are incurred in the first year, schooling costs are absent and $y\,W_j$ is substituted for W_j^f, eq. 3 is reduced to the short-cut of eq. 4.

$$\sum_j (s_{ji}W_j - s_{ji-1}W_j) \,/\, y\,E_i \sum_j (s_{ji-1}W_j) = v_i \qquad (4)$$

The JC rate of return in eq. 4 is the counterpart to the HC rate of return in eq. 2. The expressions for v_i and r_i in eqs. 4 and 2, respectively, are derived under the same five simplifying assumptions:

(a) all earnings are explainable in terms of education or occupation in the HC or JC approaches, respectively; i.e. no earning effects of personal characteristics;
(b) constant annual earnings over time, i.e. implying flat (experience) age-earning profiles;
(c) foregone earnings occurring in the first year;
(d) initial wage of starting workers is a proportion of the average wage of workers of all ages, y, and
(e) no schooling costs.

Since the simplifying assumptions apply to both approaches, it is sufficient to conduct the analysis further in terms of the short-cuts of eqs. 2 and 4. The short-cuts are specially appealing in view of the few parameters they contain and the minimum data requirements for their application.

Of course, where applicable, that part of the cost of schooling incurred by the student can be added to the denominator in each of eqs. 2 and 4 to give private rates of return. The inclusion of the total cost of schooling is obligatory in the calculation of social rates of return, i.e. rates of return as seen from the perspective of society, as a whole. The applications presented here incorporate the total cost of schooling and as such can be interpreted as social rates of return.

Before discussing the relationship between v_i and r_i in eqs. 2 and 4 a few comments are made on the pattern of s_{ji} and W_j. In many countries there are cross-tabulations of occupational and educational distributions j x i which are collected on occasions of labour force surveys. The educational distribution of an occupation changes over time due to many trends and pressures. The factors which determine the occupational-educational distribution have been analyzed in Zymelman (1980). The composition of an occupational group of people in period t undergoes adjustments in period t+1 via inflows and outflows of different educational levels, as well as age, sex and so forth. There are long and short run tendencies which shape the occupational-educational distribution. Regarding the long-run, there are the generally persistent substitution tendencies towards more capital and skill intensive production processes. These tendencies are an inherent part of economic development and imply regular rises in the skill level of most occupations. Regarding the shorter run, it can be observed that in times of labour shortages employers will accept people with less formal education. In the context of a labour surplus in a given occupation, the employers become more strict in their recruitment criteria and may demand more years of educational attainment and higher certificates. The longer-run tendencies are more relevant for our purpose.

With due consideration of the above, the profile of v_i for differing values of s_{ji} can be reviewed. Assume a ranking of j from highest paying occupation to lowest paying occupation. Then, for $s_{ji} < s_{ji-1}$ implying an occupational downgrading as a result of undergoing school course i, v_i takes a negative value. For $s_{ji} = s_{ji-1}$ implying no change in the occupational educational mix after undergoing education, v_i is zero. For $s_{ji} > s_{ji-1}$ implying an occupational upgrading, v_i is positive. Obviously, this last pattern is the most likely to occur. In the JC model there are higher returns to educations which cause greater upward occupational mobility, especially towards higher paid jobs. Primary education, being a crucial treshhold for occupational mobility, it can be expected to score higher returns in comparison to further education.

As is well established too, the higher the educational level i the higher the earning premium, W_i, and alike, the lower the educational level the lower the remuneration. The JC approach eliminates the premium and assigns all earnings to the job irrespective of the education of the job-holder. By assumption the JC approach tends to reduce the future income of a more

educated person, $\sum_j s_{ji} W_j$, and increases the future income of a less educated person $\sum_j s_{ji-1} W_j$. As a result, there is a tendency that for most i the following hold

$$r_i > v_i \text{ and } r_{i+1} + r_i > v_{i+1} + v_i \tag{5}$$

As formulated above, the calculation of v_i is not independent of the level of occupational aggregation. Suppose there is only one occupation eq. 4 will give $v_i = 0$. Suppose, on the contrary, that the number of occupations and educations are infinite, or at least as large as the work force and that there is a one-to-one correspondence between each education and each occupation. As a result, the matrix constituting s_{ji} is diagonal and $W_j = W_i$. Together, these lead to an equality between rates of return, $v_i = r_i$. If so, why should the estimates for any particular aggregation of occupations be of interest? The question can be rephrased constructively: which classification of occupations is relevant in a job competition setting? Obviously, occupations need to be distinguished in the present context in terms of productivity related properties such as the amount of physical capital and know-how associated with the occupation, the extent of routine decisions, accountable responsibility and leadership on others. The applications in this paper consider the one digit international standard classification of occupations, which reflect in limited ways only some of the above-mentioned relevant properties. But given the explorative character of the applications, the high level of aggregation need not form a problem here. In principle, the necessary data are available at a more disaggregated level for many countries and can be elaborated further.

Of course, both suppositions above of a one occupation or of a diagonal s_{ji} are hypothetical. At a very disaggregate level a one-to-one correspondence between occupations and educations is very rare. Even though, popularly, it may be taken for granted that the occupation and education of an electric engineer coincide, in reality some electric engineers may join other occupations, and vice versa.

3. Applications

The data for calculating s_{ji}, W_j in eq. 4 and W_i in eq. 2 for Indonesia and Pakistan are from the Labour Force Surveys of Indonesia (1979) and Pakistan (1979), respectively. These are supplemented by data on schooling costs from ministerial sources in each country. In the context of both countries it is assumed that children enter school at the age of six and that at the age of twelve they may forego earnings if they are at school. Furthermore, y has been estimated at 0.5 for both countries on the basis of data on the life cycle path of the aggregate wage in each country. Data are from the Household Income and Expenditure Surveys of the two countries.

Table 1 displays the raw data and the calculated rates of return following the two approaches. The calculations are made for three educational levels: primary, secondary and higher, and make use of the distinction between seven major occupational categories. Rates of return following the HC approach, r_i are consistent with and fall within the range of previously calculated rates via more elaborate methods by Hallak and Psacharopoulos (1979) for Indonesia, and by Hamdani, by Hague, and by Guisinger et al. as quoted in Khan and Irfan (1985) for Pakistan. Indonesia shows more returns to primary than secondary or higher education, which is a pattern verified for many countries; while Pakistan shows generally lower rates and a contrary ranking pattern, being one of the few exceptions.

Rates of return following the JC method, v_i, differ from r_i in two aspects. First, v_i are generally lower than r_i; as a result, the average returns on all educational levels are reduced by about 50 per cent in Indonesia and by about 15 per cent in Pakistan. Particularly, for Indonesia, the rate of return to primary education is reduced from 25.4 per cent in HC to 16.4 per cent in JC, a reduction by 35 per cent. The rate of return to secondary education is reduced by 57 per cent: from 16.4 per cent in HC to 8.7% per cent in JC, while for higher education it is reduced by 69 per cent: from 16.2 per cent in HC to 5.0 per cent in JC. Secondly, the reductions in the returns are more pronounced the higher the educational level. The job competition model gives substantive support to the hypothesis of decreasing returns to increased education. Both tendencies were briefly mentioned in the previous section, eq. 5 and are explainable in terms of the differences in assumptions of human capital and job competition models.

Table 1 emphasizes greater reductions in the rates of return in Indonesia than in Pakistan as one moves from HC to JC. These differences are due mainly to different patterns of s_{ji} in the two countries. Access to more education in Pakistan leads to major shifts in the composition of occupations. The agricultural, production and service workers who are the least paid in both countries form .91 of the noneducated but only .71 of the primary-educated in Pakistan. The shift is weaker in Indonesia: from .90 to .83. The differentiation at the upper end of the occupational categories and educational levels is also more clearly marked in Pakistan, than in Indonesia. The combined share of professional, administrative and clerical jobs - the better paid - shifts from .61 of secondary graduates to .85 of college graduates in Pakistan, as compared to a smaller shift from .71 to .88 in Indonesia. Weaker occupational-educational shifts in Indonesia can indicate an achievement of more maturity in the composition of the labour force.

Finally, the applications show that the effects of the stronger shifts in the occupational mix in Pakistan as compared to Indonesia are somewhat reduced by the lower variation in income between occupational categories which characterizes Pakistan as compared to Indonesia.

Table 1. Data and Results of different frameworks for estimation of rates of return to education

Country, year	Indonesia, 1978					Pakistan, 1978/9				
Educational level	Below Primary	Primary	Secondary	Higher	W_j	Below Primary	Primary	Secondary	Higher	W_j
Characteristics official name		elementary	senior high general	academy & university			primary & middle	metric & intermediate	college	
1. duration in years		6	6	4			8	4	2	
2. foregone years E_i		0	6	4			2	4	2	
3. costs of schooling C_i (a)		476	1535	1214			2650	7500	11350	
Conventional approach										
4. W_i (a)	82	203	555	932		6191	6960	8952	11449	
5. $W_i - W_{i-1}$		121	352	377			769	1992	2497	
6. $yE_{i-1}W_{i-1}+C_i$		476	2144	2324			8841	21420	20302	
7. r_i (b)		.254	.164	.162			.087	.093	.123	
Alternative approach										
8. s_{ji}, W_j										
j = professional	.007	.019	.131	.400	471	.010	.056	.249	.405	10077
administrative	0	.001	.016	.039	1789	.002	.011	.033	.118	16011
clerical	.017	.094	.560	.449	367	.004	.057	.327	.327	8601
sales workers	.061	.052	.036	.011	204	.070	.160	.116	.072	7873
service workers	.124	.111	.084	.048	165	.079	.108	.047	.026	6734
farm workers	.577	.449	.049	.009	85	.629	.337	.103	.033	5818
production workers	.214	.274	.124	.044	207	.206	.271	.125	.020	6220
9. $\sum s_{ji}W_j$	91	169	347	443		6191	6864	8457	9831	
10. $\sum s_{ji}W_j - \sum s_{ji-1}W_j$		78	178	96			673	1593	1374	
11. $yE_j \sum s_{ji-1}W_j + C_i$		476	2042	1908			5746	21228	19807	
12. v_i (c)		.164	.087	.050			.117	.075	.069	

(a) C and W are expressed for Indonesia in thousand rupees and for Pakistan in rupees.

(b) Row 7 = row 5 / row 6.

(c) Row 12 = row 10 / row 11.

4. Validation of HC and JC

The paper calculated two sets of estimates of rates of return to education with significantly different results. These estimates are based respectively on simplified versions of human capital and job competition models of earnings differentiation. However, the paper does not test between the alternative hypotheses of human capital and job competition. The question of which model is more applicable in a particular country is not addressed. While this question is beyond the scope of the paper, it is a prior question that needs to be asked and reflected upon.

There is a vast amount of empirical knowledge on the effect of education on earnings, most of which is moulded within the framework of HC theory. Teaching, research and policy making with regard to education economics are shaped in harmony with HC postulates.

JC theory focusses on occupations, and their properties, in explaining earnings. Validation cases of JC are well documented, cf. Versluis (1978), Yotopoulos and Nugent (1976). In contrast, JC frameworks of analysis have made less advances in teaching, research and policy making.

It is likely that many labour market situations contain elements of both HC and JC, given the empirical evidence from both sides. As such, neither theory may claim to be solely applicable to real situations. In its simplest form HC is not able to consider education as a screening device for obtaining a job or the fact that many jobs may have predetermined remuneration levels. There is ample evidence on the use of education as a signalling device by both job-seekers and firms, as well as the fixation of job salary. At the other extreme, a simple formulation of JC does not allow of educational earning differentials within an occupation, while here too there is contrary evidence.

In general terms, therefore, in the analysis of real situations there is a tendency to overestimate the return to education when using HC, while JC calculations tend to underestimate them. Because, as was mentioned above, policymaking is practically dominated by HC methods and results, a policy reorientation towards the implied results of JC seems to be a logical step.

A more integrative approach towards both theories would be to nest the hypotheses, thereby allowing earnings to depend on (a) occupations, (b) education, (c) their interaction, and (d) a host of other variables such as experience, age, sex, background and other personal and market characteristics. Increments in earnings can be written as

$$\Delta W_i = \sum_j \Delta N_j W_j + \sum_j \Delta W_j N_j + \sum_j \Delta W_j \Delta N_j + f(X_1 \ldots X_x) \quad (6)$$

where

ΔW_i = the gain in earnings associated with an additional year of education (corresponding with r_i in eq. 2)

N_j, ΔN_j = the proportion of persons in the jth occupation, and the change in that proportion with an additional year of education

W_j, ΔW_j = earnings of occupation j, and the change therein

$X_1 \ldots X_x$ = host of other variables

The first term represents the education returns due to enhanced occupational distribution of jobs (corresponding with v_i in eq. 4). The second term is the within occupation returns to education, the third term is the relatively minor interaction of the two, and the fourth term stands for the combination of factors other than those identified with JC and HC.

In terms of the results, in table 1 for instance, it is noted that the associated rate of return to higher education in Indonesia amounts to 17.6 per cent and falls down into a first term of 5.0 per cent, while all other terms amounting to 12.6 per cent, part of this is due to the within occupation returns to education and the rest to the X variables. The rate of return to education of 5.0 per cent following JC is an underestimate, but similarly the total rate of 17.6 per cent based on HC is an overestimate. The same holds for Pakistan where the values are respectively: total 12.3, first term 6.9, other terms 5.4 per cent.

In many developing countries a quantification of eq. 6 is beyond reach. Applying short-cuts to prototype approaches as was done in eqs. 2 and 4 has a special advantage in the development context, and can be helpful in guiding policy makers in reorienting investment.

4. Conclusions

Conventionally, the human capital model forms the basis for calculation of rates of return to education. In settings which manifest the job competition model estimation of rates of return to education would require an alternative formulation. Making use of occupational wages and the association between occupations and educations such a short-cut alternative is formulated and applied. As compared to the human capital model, the returns to education

following the job competition model are lower and the reductions are more pronounced for the higher educational levels. The particular shape of the access matrix of occupations by educations together with the degree of income equality between occupations play significant roles in moderating or emphasizing these tendencies, as the applications to Indonesia and Pakistan have shown.

Although the paper is not directly concerned with a validation of either theory, the policy implications are just as interesting. Given the general acceptance in policy making of the HC model and its results, any validation of the job competition model in a particular country would prescribe a shift of investment from upper to lower educational levels, and from education as a whole to other sectors.

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