

UNCLASSIFIED

CD/DOC(00)12

OECD DEVELOPMENT CENTRE



TECHNICAL PAPERS

No. 168

HUMAN CAPITAL AND GROWTH: A SYNTHESIS REPORT

by

Christopher A. Pissarides

Produced as part of the research programme on
Human Resource Development and Poverty Reduction

November 2000

<http://www.oecd.org/dev/publication/tp1a.htm>

CENTRE DE DÉVELOPPEMENT DOCUMENTS TECHNIQUES

Cette série de documents techniques a pour but de diffuser rapidement auprès des spécialistes dans les domaines concernés les résultats des travaux de recherche du Centre de Développement. Ces documents ne sont disponibles que dans leur langue originale, anglais ou français ; un résumé du document est rédigé dans l'autre langue.

Tout commentaire relatif à ce document peut être adressé au Centre de Développement de l'OCDE, 94 rue Chardon-Lagache, 75016 Paris, France. Un certain nombre d'exemplaires supplémentaires sont disponibles sur demande.



LES IDÉES EXPRIMÉES ET LES ARGUMENTS AVANCÉS DANS CE DOCUMENT SONT CEUX DE L'AUTEUR ET NE REFLÈTENT PAS NÉCESSAIREMENT CEUX DE L'OCDE OU DES GOUVERNEMENTS DE SES PAYS MEMBRES

DEVELOPMENT CENTRE TECHNICAL PAPERS

This series of technical papers is intended to disseminate the Development Centre's research findings rapidly among specialists in the field concerned. These papers are generally available in the original English or French, with a summary in the other language.

Comments on this paper would be welcome and should be sent to the OECD Development Centre, 94 rue Chardon-Lagache, 75016 Paris, France. A limited number of additional copies can be supplied on request.



THE OPINIONS EXPRESSED AND ARGUMENTS EMPLOYED IN THIS DOCUMENT ARE THE SOLE RESPONSIBILITY OF THE AUTHOR AND DO NOT NECESSARILY REFLECT THOSE OF THE OECD OR OF THE GOVERNMENTS OF ITS MEMBER COUNTRIES

Applications for permission to reproduce or translate all or part of this material should be made to:

Head of Publications Service, OECD
2, rue André-Pascal, 75775 PARIS CEDEX 16, France

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	5
PREFACE	6
RÉSUMÉ	7
SUMMARY	7
I. BACKGROUND TO THE STUDY	8
II. FEATURES OF THE SAMPLE	11
III. CONSTRUCTION OF THE HUMAN CAPITAL INDEX	13
IV. AGGREGATE RESULTS: GROWTH AND HUMAN CAPITAL	16
V. THE SECTORAL ALLOCATION OF LABOUR	20
VI. THE PRIVATE RETURNS TO HUMAN CAPITAL	25
VII. EVALUATION AND POLICY IMPLICATIONS	29
VIII. CONCLUDING REMARKS	32
NOTES	33
BIBLIOGRAPHY	34
OTHER TITLES IN THE SERIES/AUTRES TITRES DANS LA SÉRIE	36

ACKNOWLEDGEMENTS

The Development Centre would like to express its gratitude to the government of the Netherlands for the financial support given to its work on human capital in the context of which this study was carried out.

PREFACE

Decades of expenditure on education in developing countries have produced very mixed results, particularly when an analysis of the returns to investment is made. In a context of falling official development assistance and rising private-sector investment in developing countries, the question of the efficient allocation of resources to education is paramount. For this reason, the Development Centre has undertaken a number of studies in African countries to try to examine which factors in educational systems contribute to efficiency, and which do not. The results were published in Technical Paper No. 157.

This paper by Christopher Pissarides discusses the results of four micro-based studies of the contribution of human capital to growth and development in Chile, Egypt, India and Tanzania, extending the idea of efficiency within the formal educative process to the efficiency of the utilisation of education and human capital within the economy as a whole. While economists, sociologists and politicians combine to declare that human capital formation is essential for growth and that this justifies subsidies for education, this paper finds that subsidies may actually have a harmful effect on growth, if the type of education and training they stimulate fails to supply the labour needs of the economy. The preliminary studies, on which the argument here is based, do indeed demonstrate the essential link between the labour market and the output of the educational system for growth in all the countries considered.

A joint UNESCO/Development Centre conference in October 2000 emphasised that the relationship between investment in education and growth is very complex and cannot be reduced to a simple, public good argument. The paradox of globalisation, and the accelerated growth which can go with it, is that less, rather than more public funding is available for development projects. Hence, the private sector must be encouraged to participate in such projects, while public money must be spent more efficiently than perhaps hitherto. Education is a sizeable item in national budgets and aid funding, but education is also essential to growth. The four country studies analysed here do not precisely describe the exact balance between the two effects. Since the exact balance between the two effects does not emerge from the micro-based studies, further research is needed — taking into account the caveats contained in this paper.

Jorge Braga de Macedo
President
OECD Development Centre
November 2000

RÉSUMÉ

La conclusion principale de cette étude du point de vue de son implication pour l'orientation des politiques est la suivante : subventionner l'enseignement s'il n'y a pas dans le même temps création d'emplois générateurs de croissance peut être une bonne chose pour les individus mais une mauvaise pour la croissance (et vraisemblablement pour les finances publiques). Les observations confirment le niveau élevé du rendement de l'éducation, sous forme de meilleurs salaires pour les diplômés ; mais les faits montrent également que ces rendements ne sont pas toujours associés à des rendements sociaux équivalents, sous forme d'une augmentation de la production. Les pouvoirs publics doivent s'assurer que les hommes et les femmes éduqués sont incités à occuper des emplois qui améliorent le bien-être social. Certains de ces emplois, tels que la gestion de services sociaux ou les soins aux malades n'apparaissent pas dans les statistiques de croissance. Ils sont toutefois aussi valables que ceux qui y figurent.

SUMMARY

The main policy implication that emerges from this study is that subsidised education without at the same time provision for the creation of growth-enhancing jobs can be good for the individual but bad for growth (and presumably public finances). There is evidence of very high private returns to education, in the form of higher wages for degree holders, but also evidence that these returns are not always matched by social returns in the form of higher output. Governments need to ensure that educated men and women have incentives to work in occupations that contribute to social welfare. Admittedly, some of those occupations, such as the running of social services or the looking after of sick people, do not show up in growth statistics. But they are as valuable as those that do.

I. BACKGROUND TO THE STUDY

The role of human capital in economic development has been a frequent theme in the theoretical and applied literature. The belief of policy makers that human capital is a key contributor to economic development has led, virtually everywhere in the developing world, to the provision of subsidised education. The theoretical literature on growth and development has provided backing for this policy, by claiming that education is both a key contributor to growth but also that its social rate of return is likely to exceed its private rate of return¹. The logical conclusion is that even a well functioning market economy is not likely to invest enough in education without government subsidies.

Yet, the empirical literature has been unable to identify robust mechanisms through which education and training contribute to economic development². Although suggestions abound, authors of empirical papers are rarely able to agree on the degree to which human capital contributes to economic development and why there is such diversity in the empirical estimates. This is especially true of the aggregate literature. In empirical studies physical capital invariably has an influence on the growth of aggregate output, with the estimated coefficients corresponding more or less to those derived in the theoretical literature on growth; human capital is sometimes found to be significant, sometimes insignificant and most often with a variety of estimated coefficients that do not always make theoretical sense.

Human capital is generated and put into use in labour markets. The structure of the labour market is therefore critical for the quantity and quality of human capital that is generated and for the uses to which it is put. The structure of the market will determine, for example, how much human capital is put into growth-enhancing activities and how much into other activities, such as redistribution. It will also determine what types of human capital will be demanded. Yet, despite the popularity of the recent growth literature, not many labour economists have studied the relation between human capital and growth. Research in growth has become the domain of macroeconomists whose data on labour markets amounts to two or three aggregate series — usually for employment, schooling, and participation rates. As a result, progress in the integration of labour-market institutions with aggregate growth has been slow. Looking at the data that macroeconomists have available on labour markets, and at the propositions put forward by growth theorists for the link between labour-market outcomes and growth, it becomes obvious that not much progress can be made within the current cross-country research agenda. Deeper country research is needed that pays attention to the institutional structure of the country in question and to the links between human capital, the institutional structure and the sources of growth.

Prompted by this realisation, this project commissioned micro-based work on the contribution of human capital to growth and development in four countries which were to serve as case studies for a thorough evaluation of the role of human capital in economic development. The four countries are India, Egypt, Tanzania and Chile. The reasons for their selection are discussed below. The studies were to provide more thorough tests of some hypotheses about the relation between human capital and growth that were previously analysed with cross-country data.

Two reasons were highlighted by the project as likely causes for the failure of the empirical literature to estimate the contribution of human capital to growth at the aggregate level. First, the traditional neo-classical approach to economic growth misses important points about human capital. In particular, it misses the point that unlike physical capital, human capital responds to incentives that raise its own private return and that sometimes the higher private rate of return is not derived from growth-enhancing activities. This is what is known sometimes in the literature as “rent seeking”. Individuals may seek to extract economic rents from others, or from institutions, instead of putting their efforts into creating new wealth. In contrast, physical capital, when active, produces goods that contribute directly to output growth (on the reasonable assumption that rent-seeking activities are not capital intensive)³. A cross-country study of rent-seeking activities via public sector employment was also commissioned by the project, to provide background to the country studies⁴.

Second, even if we identify mechanisms which are able to distinguish between the incentives that are growth-enhancing and those that encourage rent seeking, it would be difficult to identify and test the validity (even less so the quantitative significance) of these mechanisms by making use of aggregate data. A micro-based investigation has a better chance of shedding some light on the issue by concentrating on the mechanisms that encourage the rent-seeking; namely, by investigating the sectoral employment of human capital and asking whether the sectors that occupy a large fraction of the human capital stock are growth-enhancing.

The underlying belief in the development literature on rent seeking is that the opportunity to engage in rent seeking is provided by policy regulation and employment in the public sector, where incentives for profit maximisation through production are usually absent. So a primary interest of the study was the analysis of public-sector employment and the degree to which human capital was invested in public-sector activities. Is there any relation between public-sector employment and the contribution of human capital to economic development? Can it be claimed that human capital contributes more to economic development when the public sector absorbs less of it? These were key questions that were posed at the beginning of the study.

Another recurring theme in the literature, of fairly recent vintage, addresses the positive incentives available to human capital. A particular mechanism that is identified as providing incentives for trained labour to engage in growth-enhancing activities is trade liberalisation⁵. Trade liberalisation increases the degree of competition and competition normally reduces the opportunities for rent seeking. More specific mechanisms associated with trade liberalisation provide incentives for maximising the private rate of return to education through growth-enhancing activities. First, the contact of trade — the trading technology itself — is skill-intensive. Trade needs packaging and paper work that conforms to international standards and often needs some knowledge of foreign markets to a degree that only educated labour can have. Second, traded goods are usually of higher skill content than those produced and consumed at home, especially for developing countries. Once trade has been liberalised and the protective barrier of tariffs and direct restrictions has been lifted, home producers need to invest in new technology to compete with foreign suppliers. Third, the exposure to the foreign markets that trade brings enhances the knowledge of domestic producers of superior technologies. Such technologies are usually complementary to skills because of the abundance of skilled labour in more advanced countries. Their importation increases the wage premium paid to skilled labour in developing countries and so encourages the redeployment of skilled labour to trade-related activities.

Thus, a second objective of the project was to investigate the extent to which trade liberalisation led to a higher contribution of human capital to economic growth. Is it true that a country with more educated labour force can take more advantage of the growth-enhancing possibilities of trade liberalisation? And conversely, does trade liberalisation lead to a higher contribution of human capital to economic growth? In order to answer these questions the authors of the background papers to this study were asked to identify periods of trade liberalisation in their countries and investigate the joint contribution of human capital and trade in the growth process. Naturally, the analysis would benefit from narrowing down the effects of trade liberalisation to the tradable sectors of the economy.

The selection of countries for the study was dictated largely by the objectives. Countries with something special to offer in one or more of the three blocs, trade, education and growth were to be preferred. In addition, because the study could not extend beyond a small sample of countries, some diversity in the selection of countries was desirable. For these reasons, the selection of the countries for the study was not random. The principles underlying the particular choices that were made are explained below.

The country research was to concentrate on three aspects of growth. First, an aggregate time series analysis was required to provide the background to the more micro-orientated research. Although the period of analysis was to be as long as feasible, it was not anticipated to extend beyond the early 1960s. The data requirements for this part of the study are aggregate annual time series for output (GDP), physical capital, human capital and labour. Second, the possibilities for rent seeking were to be explored by undertaking an analysis of the sectoral composition of employment and in particular the allocation of human capital between the private and public sectors of the economy. The data requirements for this part of the study are the sectoral composition of employment by skill. Third, household surveys were to be used to estimate the private rate of return to human capital at the individual level. This estimate can shed light on the incentives that labour has to acquire education and whether these incentives are linked to trade liberalisation or rent seeking.

II. FEATURES OF THE SAMPLE

The features of the five countries in the sample that made them attractive as special cases for the investigation of the role of human capital in economic development are as follows.

India is a large country with a relatively educated workforce that embarked on a process of trade liberalisation in the early 1990s⁶. Liberalisation has been slow and it is too early to do a thorough analysis of its impact on growth and the returns to human capital. Before 1990, India had a large number of trade restrictions in force and was, as a result, an inward-looking economy with little reliance on trade. It is therefore a good special case for the investigation of the relationship between human capital and growth in a large country with a lot of regulation and not exposed to foreign competition. GDP growth per capita has been fast in recent decades but its level is still one of the lowest in the world.

India's growth performance has been mixed (see Table 1). Growth was slow in the 1970s but fast in the 1980s. It slowed down again in the 1990s. Industrial growth was even more marked in the 1980s than total growth. From a low of 4.59 per cent in the 1970s, it jumped up to an average of 8.37 per cent in the 1980s before declining again.

Egypt is a second large country with a lot of spending on education and a rapidly growing stock of human capital throughout the period⁷. Its growth performance has been erratic, with slow growth up to about the mid-1970s, fast growth until the early 1980s but slow growth again thereafter (see Table 1). A process of trade liberalisation and more openness began around the mid-1970s but several restrictions have remained, for example in foreign exchange and the determination of the exchange rate, where official rates did not reflect market values during the period of analysis. The main feature of Egypt, however, that made it attractive as a country for this project is its large public sector and the job guarantee that the public sector used to give to university graduates. This provides a textbook example of opportunities for "rent seeking", in the sense that the incentives offered to school leavers seeking higher education were directed towards public sector jobs.

Table 1. **Rates of Growth of GDP**
per cent

Period	India	Egypt	Tanzania	Chile
1960-70	3.8	4.2	5.3	5.2
1970-80	3.2	9.1	3.2	2.4
1980-90	5.7	2.3	2.5	3.3
1960-90	4.2	5.2	3.7	3.6
Per cap. 1980-92	3.1	1.5	0.0	3.7
Per cap. level, 1992	310	640	110	2730

Notes: Growth rates for total GDP is from the country papers except for Chile, which are from the Penn World tables. Per capita growth and level (in 1992 US dollars) are from the World Development report, 1994.

Tanzania is the poorest country in the sample, with income per capita of \$110 in 1992, a low rate of literacy and low growth⁸. Growth was fast for a short period after independence in 1961 but several measures of economic regulation and “socialisation” introduced after 1967 led to economic decline. Although primary school enrolment has improved steadily since 1961, secondary school enrolment remains one of the lowest in the world, at about 5 per cent in the mid-1990s. The interest in Tanzania was in the question of whether the country’s low growth performance could be attributed to its low human capital accumulation and conversely, despite the low human capital stock, whether the rate of return to human capital was still low, because of the excessive regulation.

Finally, Chile is included in the sample as a success story whose programme of liberalisation that started in the mid-1970s has been widely credited as being responsible for its fast growth. Chile’s per capita level of GDP and rate of growth have been much higher than in the other countries in the sample. Chile’s programme of liberalisation was more comprehensive than that in the other countries and came earlier. Its stock of human capital grew quickly in response to private incentives, so the main interest in the project was to see whether trade liberalisation provided the incentives for the population to seek more education and engage in growth-enhancing activities⁹. Trade grew very fast after the liberalisation but Chile is richly endowed in natural resources and a lot of its export trade is in natural resources.

Chile underwent two major “liberalisation” events. Starting in 1975, trade was liberalised through the abolition of non-tariff barriers and the reduction of tariffs to low and non-discriminatory levels. By 1979, tariffs went down from an average rate of 76 per cent in 1974 to about 12 per cent and the black-market premium in the exchange rate, which stood at more than 100 per cent, all but disappeared. The second event is the massive depreciation of the currency in 1982-89, which resulted in real depreciation of over 100 per cent. This followed a deep balance of payments crisis and recession in the early 1980s, associated with the Latin American debt crisis and domestic policy errors.

Table 1 shows that whereas GDP growth in the 1960s was robust, it faltered in the 1970s, dropping from 5.2 to 2.4 per cent on average. It picked up again in the 1980s, and, had it not been for the large declines in GDP in the early 1980s, the average would have been a lot higher. Chile is an important special case for this study because it is the only country that liberalised its economic regime and opened to trade early enough to provide sufficient observations of the changes that accompanied it. Unfortunately, the case study does not link the outcomes of trade liberalisation with the stock of human capital but there is enough information to derive conclusions about the impact of trade liberalisation on the return to human capital.

III. CONSTRUCTION OF THE HUMAN CAPITAL INDEX

India

The report on India uses World Bank estimates of the human capital stock for the entire population. Definitions and construction method are not discussed. The only information given is that the measure used is the average number of years of schooling. This measure increased at about 3.51 per cent per year on average over the period 1960-90, with a faster rise in the first two decades of the sample. Virtually all boys and about 83 per cent of girls up to age 11 were enrolled in schools by the mid-1990s and although the proportions in the 11-14 year age group drop to 73 per cent and 45 per cent respectively, they are still much higher than they were at the beginning of the sample.

In primary schools, the increase in the number of pupils outstripped the increase in teachers, so the pupil-teacher ratio increased from 48 in 1961 to 57 in 1988. This may indicate a fall in the quality of schooling, but for secondary schools and colleges the pupil-to-teacher ratio actually fell.

With regard to the educational qualifications of the employed population, only estimates for the rural and urban population separately are given but not for India as a whole. Moreover, the percentage distribution for women adds up to a number greater than 100, which casts doubts on the reliability of the data. Nevertheless, the figures for men show a large percentage of illiteracy in both urban and rural areas (Table 2) but one that has declined during the sample period. The decrease during the 1980s for the country as a whole was about one third.

Table 2. **Percentage Distribution of Employment by Highest Education Qualification**

Education	India Men, 1988		Tanzania Household Heads, 1991		
	Urban	Rural	Urban	Rural	All
None	20.5	49.8	34.1	47.1	44.8
Primary	31.0	29.9	53.4	48.9	49.7
Secondary	37.0	18.5	9.0	1.9	3.1
Higher	11.5	1.8	1.0	0.0	0.2

Egypt

For Egypt, the human capital series was constructed for the project from data on years of completed schooling and enrolments by applying the inventory method. Population censuses for the years 1960, 1976, 1986 and 1996 were used to calculate the mean years of schooling of the population 10 years of age or older. The census gives an underestimate of mean years because it only includes schooling that led to a qualification but a partial correction was made for those still at school, by adding half the number of years in the schooling cycle presently enrolled. Enrolments were then added, less an

arbitrary number for “wastage” and deductions were made for migration. No corrections were made for retirements from the labour force. The latter, however, is unlikely to introduce serious bias because of the low level of qualifications of older Egyptians.

The series for Egypt are probably as good as one can hope to get for a developing country. The four census years provide benchmarks for the accumulation method used to construct the time series between censuses and the agreement between the constructed series and the census estimate is good. The results show that the aggregate stock of human capital grew steadily since 1960. As would be expected for a series growing up from a small base, the rate of growth declined from about 5 per cent at the beginning of the sample (1960) to about 3 per cent in the 1990s.

An attempt was also made to estimate the quality of the human capital stock. Attempts to measure it by making use of public spending on education proved unsuccessful. The only indicator of quality that could be constructed in a time series was based on the number of pupils and teachers. The pupil-to-teacher ratio declined steadily after 1975 in all types of pre-university education, from about 35 on average to about 20. But the average class size increased from about 40 in 1960 and 38 in 1975 to 42 in 1995. Unfortunately, no statistics comparable to those in Table 2 for the other countries can be reported because of the absence of data in the country report.

Tanzania

The definition of human capital in Tanzania is similar to the Egyptian one but covers only the working-age population: 14 to 65 years. There are two censuses in Tanzania with detailed age distributions of people in school, taken in 1978 and 1988. These provide stock estimates for the years of schooling in the population as a whole. An inventory method is then used to construct a time series. The aggregate human capital stock is augmented by enrolments and by the human capital stock of those who reach age 14 and reduced by deaths and retirements. The author calculates from a census year that death and retirements account for about 3 per cent of the human capital stock and uses this estimate as his depreciation parameter. However, this depreciation rate may be too high, given that older people have less education on average than younger ones.

The resulting estimate shows a continuous increase for the aggregate human capital stock from 1961 to 1995 but because of fast population growth during those years there is a decline in the average stock from the 1961 level of 3.63 years to 2.69 years in 1975. Subsequently it increased, reaching 3.89 years in 1995.

Table 2 reports the distribution of the labour force by educational qualification. Despite the recent improvements in the provision of education, only a small fraction of the labour force has education qualifications beyond primary school, the vast majority being almost evenly divided between those with no qualifications and those with just primary school education. About 80 per cent of Tanzania’s work force is occupied in rural areas.

Chile

Data availability in Chile is far better than in the other countries in the sample and no construction of data series for this particular study were necessary. The main source of data is an annual household survey for Greater Santiago, which accounts for about 40 per

cent of the Chilean population, conducted since 1957. Unfortunately this biases the sample against agriculture, fishing and mining, which accounts for about 15-20 per cent of GDP. The sample is close to 10 000 per year with 4 000 to 5 000 working full time. Respondents are asked to give information about their schooling and work experience and the schooling information is the source of the human capital index used in this study. Table 3 summarises the educational qualifications of employed men and women.

Table 3. Percentage Distribution of Employment by Highest Education Qualification
Greater Santiago, Chile

	Men			Women		
	Below high school	High school	Higher	Below high school	High school	Higher
1966-70	80.6	11.0	8.4	70.2	19.8	9.6
1971-75	72.4	15.2	12.4	57.3	26.9	15.8
1976-80	68.1	17.9	14.0	47.2	31.9	20.9
1981-85	60.6	24.8	14.7	36.2	40.0	23.8
1986-90	53.1	29.2	17.7	32.7	39.6	27.7
1991-96	48.4	31.9	19.8	29.3	42.5	28.2

The data in the Table clearly indicate fast growth in educational qualifications. Even as recently as the late 1960s, 80 per cent of men and 70 per cent of women in the Santiago area were leaving full-time education before completing high school. By the 1990s, these percentages dropped to 48 and 29 respectively. Growth in schooling seems to be fast and uniform throughout the period, though the fastest growth appears to be in the late 1980s, when the economy and exports were booming. However, there is no clear evidence that the switch to openness and trade as channels for development were particularly conducive to the acquisition of human capital. The early 1970s appears to be as good a period for growth in schooling as other periods.

IV. AGGREGATE RESULTS: GROWTH AND HUMAN CAPITAL

Aggregate results are useful to the extent that they point out any relationships in the data (or the absence thereof) that need further investigation. They cannot establish robust links between variables nor can they usually discriminate between different transmission mechanisms, because the reduced forms that they estimate are consistent with a variety of microfoundations. Usually, aggregate studies are plagued with econometric problems that make their point estimates unreliable. However, if, say, human capital fails to show a significant contribution to output growth, it is unlikely that a more micro-based analysis will show it up as significant. There is a risk running in the other direction, significant correlations at the aggregate level may turn out to be spurious upon more careful scrutiny (for example, if both variables are trended and no careful de-trending is done before estimation).

The most helpful way to think about the aggregate relationship between human capital and GDP growth is in terms of an aggregate production function. The simple production function used by Solow (1957) in his growth accounting exercise consisted of output as the explained variable and capital and employment as the explanatory variables. Anything unaccounted for by the two explanatory variables was attributed to “total factor productivity” (TFP) growth. The question addressed by the aggregate studies is whether growth in human capital can account for some or all of TFP growth. Obviously, even if the answer is in the affirmative, a large number of mechanisms is consistent with this framework — for example, there may be importation of a skill-biased technology from abroad or there may be an R&D technology that uses educated labour, to name two.

India

The estimate of an aggregate production function for India gives encouraging results for the role of human capital in enhancing TFP growth. Because of data limitations, in particular the unavailability of a reliable employment index for the whole economy, the authors of the TFP regressions estimated regressions for industry only. Industrial output is more volatile than GDP, but the correlation between the two appears high (no precise numbers are given). So, given that variations in the human capital stock are not a cyclical influence on output, the estimation of industrial regressions instead of GDP ones biases the estimates against human capital.

Industrial employment and capital stock can be reliably measured. Employment was calculated from the annual survey of industries and it covers all employees in all industries. The capital stock is measured by making use of a stock estimate for 1980 and the series for gross fixed capital formation from the national accounts. The human capital variable used, however, was the one for the economy as a whole, measuring the average number of years of schooling for the population as a whole. This was dictated by data availability, since no estimate of the industrial employees’ human capital stock was available. However, since the variable of interest is the rate of growth of this stock, making use of the all-India index is unlikely to introduce serious bias.

The aggregate results for India show a significant contribution of human capital to industrial growth. The authors have tried to distinguish between the role of human capital as a factor input, along with capital and labour, and as an input into TFP growth. In the

latter case human capital influences the productivity of the other two factors through the (exponential) shift parameter in the production function. Although the tests are not strong enough to distinguish between the two hypotheses, statistically the human capital index was always significant. The most satisfactory regression is one that estimates a standard aggregate production function with constant returns to scale in capital and labour and includes the average number of years of school as a variable that influences TFP. The estimate suggests that an increase in the average number of years in school by one year increases (industrial) output by about 30 per cent. Although this estimate is high, especially if it is interpreted as a rate of return to human capital, note should be taken of the fact that the average number of school years in the sample moves within a narrow range, despite apparent fast growth. For example, at mean 1980s values, it took on average three years for the mean number of school years to increase by one year. Nevertheless, the aggregate estimates for India are encouraging and conform to macroeconomic thinking. It would appear that at this level, institutional constraints or the closedness of the Indian economy did not play a significant role in restricting the contribution of human capital to economic development.

Egypt

The series for GDP used for the regressions in Egypt was constructed from World Bank sources, by piecing together two series in current Egyptian pounds and deflating the whole series by the wholesale price index. Similarly for investment, the same sources were used and then the capital stock constructed with an inventory method by applying 6 per cent depreciation rate. A base year estimate for the capital stock was derived by applying a fixed ratio of capital to GDP in one year (1.5 in 1970). It should be noted that the constructed series do not correspond precisely to a series for GDP in constant US dollars reported by the World Bank.

Calculation of an employment series proved to be the most problematic part of the study. The final estimate used made use of census estimates for the years 1960, 1976, 1986 and 1996 and extrapolated inter-census years by assuming constant growth rates. Of course, such a technique smoothes out cyclical fluctuations in employment, which is usually the variable that bears the brunt of cyclical movements in GDP. For this reason, results derived with a GDP series not smoothed should be treated with caution.

The results reported at the aggregate level appear to suffer from the above problem. GDP is highly cyclical, whereas employment is the smoothest variable in the regressions (see Figure 8 in Fergany, 1998). Average years of schooling and capital are also smooth, as they can be expected to be, so the aggregate regressions fail to pick up any significant relationships between GDP or TFP growth on the one hand and the other variables on the other, with only one exception, the relation between the rate of growth of GDP and the rate of growth of the capital stock.

Notwithstanding the paucity of results, and the inappropriateness of the aggregate data for this kind of analysis, some features of the data stand out in Egypt that are worthy of note. TFP growth has been very flat and in the calculations reported it emerges mainly as a cyclical variable. The implication is that Egypt has not succeeded in exploiting its transformation into a more liberal economy in the mid-1970s and it is still plagued by the problem that it suffered in the earlier period. Fast growth in the second half of the 1970s could well be associated with oil wealth more than with the process of liberalisation, since

the improved performance did not continue after the oil wealth declined in real value in the 1980s. Indeed, the author of the report on Egypt makes the convincing argument that Egypt has embarked on a process of transformation to a modern open economy that is taking too long to materialise, for reasons that are not clear. The reforms of the mid-1970s do not appear to introduce structural breaks to the regression results, justifying his scepticism.

The quality of the human capital stock is also brought into question as many boys and girls embark on studies that are not likely to contribute to economic growth but are likely to get them public-sector jobs instead. Although the job guarantee in the public sector has now ended, and in any case public-sector jobs are not now as well rewarded and as sought after as they used to be, public-sector employment was the main ambition of trained graduates during the sample period.

Tanzania

Results for Tanzania are less encouraging than for India, though not as poor as for Egypt. The problem with Tanzania appears to be one of data. Given the regulation that plagues the Tanzanian economy, a lot of economic activity takes place underground and escapes the official statistics. The availability of aggregate data is consequently poor. There is a long time series for GDP and gross investment, extending from independence in 1961 to 1994 (referred to below as the unrevised series) and a revised estimate for 1987 to 1996. The author experimented with both time series, correcting the unrevised figures before 1987 by making use of the ratios of the revised to unrevised data during the overlapping years. The capital stock was constructed by making use of the gross investment time series starting with a zero initial figure in 1945 and applying alternative depreciation rates of 5 or 6 per cent. In the absence of reliable measures for employment, the entire working age population was used in place of employment. In other words, changes in the participation rate over the sample period were (by necessity) ignored. As with Egypt, the derived labour force series does not reflect any economic shocks, cyclical or otherwise, whereas the GDP and investment series do.

In the estimation, no time series gave robust results that one could confidently report but the unrevised data for both GDP and the constructed capital stock gave more satisfactory results than the revised series. As a way out of the problem, the author constructed a series for TFP growth by applying the conventional growth accounting methodology and borrowing coefficients for capital and labour from other studies (namely, assuming that the coefficient on capital in a Cobb-Douglas production function is 0.3 and on labour 0.7, figures that are commonly used and correspond also to the ones estimated for India). He then correlated the constructed TFP series with the series for average years of schooling. The result was an elasticity of TFP with respect to human capital of about one. This estimate is high by conventional standards and derived under several restrictions, so it is suggestive only of a potential significant contribution of human capital growth to TFP growth.

Chile

The calculation of TFP growth in Chile followed similar lines but although more care was exercised in the selection of share parameters for capital and labour less attention was paid to the influence of human capital on TFP growth. A constant-returns production

function was used to net total output growth of the effect of growth in the capital stock and labour. The weights used were calculated from sectoral data (no information is given on the sectors selected) by assuming that each sector has fixed weights, namely its own Cobb-Douglas production function, but the aggregate weight changes as the sectoral composition of employment changes. This is naturally more satisfactory than assuming an aggregate production function with constant shares, as it subsumes the latter. The mean value of the share of capital obtained in this calculation was 41.2 per cent, which is higher than the conventional measure of 30-35 per cent used in OECD countries, but still lower than the share estimated with aggregate Chilean data.

The capital stock was calculated by applying the perpetual inventory method with 5 per cent depreciation. A benchmark value for the capital stock was obtained from the steady-state relation that links growth with capital stock — not unlike the assumption of a constant capital-output ratio — and for employment a national series for all labour employed was available for use. The traditional measure for TFP growth can be accurately constructed by making use of these time series. The authors attempted some corrections for the utilisation of the capital stock and for the quality of capital and labour but results were not different from the ones obtained with the conventional measure.

We discuss the main features of the constructed series for TFP growth below. First, mention should be made of the way that human capital was used in this exercise, given the project's focus. The series for the mean years of schooling for the Greater Santiago area was first multiplied by the share of labour in production and the outcome treated as the contribution of human capital in TFP growth. This measure moves very slowly over time, given the steady rise in mean schooling years, and does not contribute much to TFP growth. Indeed the authors use it only to correct for the "quality" of the labour force. But its use requires some strong assumptions about the role of human capital in growth that do not conform with recent thinking. First, it restricts human capital to the status of a labour-augmenting technological parameter, whereas recent thinking in the economics of human capital finds it more likely that human capital contributes to TFP growth independently of labour's contribution to production. Second, even if human capital enters a neo-classical production function as a factor of production in symmetry with other factors, its coefficient is not necessarily equal to that of total labour.

Given the limitations of the assumptions used to derive the effects of human capital on TFP growth, it is more appropriate to disregard any influence of human capital estimated in this way, and take the total TFP growth series as the best available estimate of TFP growth in Chile. This series shows mainly a cyclical pattern up to the mid-1980s, when it starts growing steadily. Average growth in the 1970s and 1980s was, respectively, 0.02 and 0.23 per cent but in the 1990s it went up to 3.15 per cent. But since the late 1970s and late 1980s were periods of growth whereas the early 1970s a period of decline, TFP growth appears to be associated with periods of trade liberalisation. This is shown formally in regressions of TFP growth on an index of trade liberalisation, which summarises information on tariffs, quantitative restrictions and the black market premium on the exchange rate. The index of trade liberalisation is always a strongly significant explanatory variable in TFP regressions. Other significant variables include inflation and unemployment, which reduce TFP growth and pick up the cyclical effects on growth. Unfortunately, the human capital index was not used as a regressor in TFP regressions. Although this deprives us of any conclusions about the contribution of human capital to TFP growth before and after trade liberalisation, it does not bias the results about the influence of trade liberalisation on TFP growth.

V. THE SECTORAL ALLOCATION OF LABOUR

One of the reasons that human capital may be diverted from growth-enhancing activities is that it may have opportunities to engage in rent-seeking activities. By looking at the sectoral allocation of labour we may be able to glean some information on this issue. Although there are several possible “engines of growth,” even without knowing the precise engine of growth in a country we can associate employment in some sectors with growth-enhancing activities and in some others with other types of activity. For example, in some countries growth is strongly associated with the export sector or with the growth of manufacturing. In more advanced countries, employment in R&D activities is a good example of growth-enhancing employment. In the transition countries of Central and Eastern Europe, employment in newly founded small- and medium-sized enterprises is sometimes taken as an indicator of growth-enhancing employment, and so on.

Unfortunately, the employment decomposition that we could get for the countries in our sample was not as detailed as we would need for a general analysis of employment and growth. Interest focused instead in public-sector employment, especially in the administrative public sector (excluding health and education). It should be noted from the outset that the suggestion is not that public sector employment is necessarily bad. Of more interest is the comparison of the size and composition of public sector employment across countries and how this compares with their growth performance.

India

In India the government has subsidised the provision of education, especially of technical education that was thought to be conducive to industrial development. But at the same time it introduced many restrictions on large enterprises which gave them some monopoly rights in output markets. Labour markets were also regulated, making it very difficult for large enterprises to dismiss employees. This gives employees additional opportunities for rent extraction. Public enterprises were also restricted in their flexibility in adjusting employment. So, policy regulation in India appeared to offer opportunities for rent seeking in both the private and public sectors, especially in large enterprises.

The response of large enterprises to the restrictions was to hire fewer employees on long-term contracts than otherwise. As a result unemployment of graduates in India is high, probably one of the highest, relative to overall skills, in the world, and migration by qualified labour is also very high. The situation created in India is one where the private return to human capital of those with jobs is higher than the social return but the existence of a large unemployment pool reduces the average return to human capital of all school leavers.

The public sector in India does not employ a large fraction of the labour force but there is evidence of rent extraction. In the early 1990s, public administration employed 1.2 per cent of the population, which compares favourably with the OECD average of 7.7 per cent and the average for the Middle East and North Africa, 3.9 per cent¹⁰. But unlike the OECD, where the average wage in the public sector is about 50 per cent higher than per capita GDP, in India it is four times as high. Also, there are many other benefits

attached to a public sector job, such as subsidised housing. State enterprises pay on average twice the average wage of private enterprises, despite the fact that they employ on average a less qualified work force.

The implication of the high wages paid in public-sector jobs is the existence of long queues to get into the public sector and resistance to change by the incumbents. The high relative wages indicate high private returns to education, which can clearly be attributed to the fact that jobs are protected in the public sector. There are, as a consequence, large and aggressive trade unions which secure many rents for the workers. The average level of qualification of public-sector employees is higher or inappropriate for the job in question, as when qualified engineers get jobs in public administration.

Labour force evidence indicates that the private rate of return to human capital in the public sector is higher than outside and that a lot of qualified workers are attracted by it and employed in jobs where their social product is below potential. The evidence on the rate of return has already been mentioned, it is embodied in the higher relative wages in the public sector. The evidence on the misallocation of qualified workers is a natural consequence of the high relative wages but there is also some direct evidence. For example, in 1994, of those who succeeded in the civil service examinations for a job in public administration, 38 per cent were qualified engineers and 5.5 per cent qualified doctors.

Egypt

In Egypt, the government has also subsidised education heavily but without any obvious objective about the type of education that is to be subsidised. In contrast to India, during the period under review, it guaranteed employment in the public sector to anyone with a higher or intermediate degree. Jobs in the public sector are protected, so there is a large element of rent seeking on the part of those who secure them. Also, although recently the guarantee has become almost empty and wages in the public sector have been falling, those holding public-sector jobs usually get another job in the private sector to augment earnings. So public-sector jobs still offer rents for those that can secure them.

The result of the guarantee of public-sector employment was a rapid growth in educational attainment but in subject areas that were not needed by industry or private services. Thus the majority of new graduates either obtained or queued for government jobs, giving rise to a very unusual pattern for unemployment. Unemployment in Egypt is virtually confined to those with intermediate education or above and is high by international standards; for example, in 1995 those with intermediate education suffered unemployment of 32 per cent and those with a university degree of 19 per cent, whereas those below intermediate-level qualifications suffered virtually no unemployment (below 5 per cent).

There is also evidence of underemployment of qualified labour. This takes mainly the form of dissatisfaction with the current occupation, revealed in response to questioning as part of the labour-force survey. But this underemployment is subjective. A large fraction of qualified labour works or wants to work for the public sector where from society's point of view they may be more underemployed than in a private job which they say they want to leave.

Wage-setting for qualified labour in Egypt is dominated by the public sector because of its size. As we argued, the behaviour of public-sector employees reveals that there are still rents in public-sector employment but public-sector earnings have suffered more than private-sector earnings since the mid-1980s, when the economy went into recession. In

fact, in the mid-1990s qualified labour earned more per year of education in the private sector than in the public sector, though the gain was far greater for men than for women (see also below for some qualifications to this claim). Wages in both public and private sectors since the mid-1980s declined by about 30 per cent on average, with bigger declines in the public sector.

Tanzania

Data for Tanzania are more limited than for the other two countries. Enterprise surveys cannot be used because they cover only formal employment, which accounts for less than 10 per cent of total employment. But two household surveys, one for 1976 and one for 1991 give more information on the sectoral distribution of employment.

In 1976, virtually everyone in rural areas with more than three years of schooling and about 76 per cent of those in urban areas were employed in the public sector. Thus, although the public sector was small by international standards, employing only 5 per cent of workers in rural areas and 11 per cent in urban areas, it employed more than 80 per cent of those with three years of schooling or above. Cash earnings, although a minority of all income in the majority of households, were greater in the public sector for comparable qualifications and far greater in households headed by individuals with some schooling than those without.

By 1991, the share of the public sector in the employment of qualified labour declined but it was still above 50 per cent. The informal sector, however, appears as a significant employer of qualified labour, accounting for about 15 per cent of the employment of those with secondary education and 12 per cent of those with university degrees. The most astonishing change, however, between 1976 and more recent years was in the real earnings of public sector workers. According to World Bank sources, the earnings of qualified public sector employees in 1986 were only 18 per cent of their 1976 level in real terms. As a result, in 1991 qualified workers working in the private sector earned more in real terms than those employed in the public sector.

The public sector in Tanzania appears to offer opportunities for rent extraction beyond the real wages that it can afford to pay. For example, the majority of university degree holders who are employed in the public sector also have second jobs that their public position opens to them. There is indirect evidence that the power that public sector employees have in the distribution of foreign aid is a source of rent extraction and although the reforms that have taken place since the mid-1980s have reduced these opportunities, they have not eliminated them. The share of labour with three or more years of schooling that the public sector in Tanzania absorbs is evidence that there is misallocation of human capital. The recent growth of informal sector employment for these individuals, however, is indication that reforms that reduce the possibilities for rent seeking through public sector employment can release labour for more productive employment in the private sector. The fact that Tanzanian growth has picked up since then is supportive of this argument.

Chile

Chile, at least in the 1990s, was at a very different level of development from the other three countries and it is difficult to make the argument that public sector offers many opportunities for rent extraction. The biggest share of public sector employment is in local

government and social services, which (in 1991-96) employed 11 per cent of men and 33 per cent of women (in the Greater Santiago area). Employment in central government is given jointly with employment in financial services in Bravo *et al.* (1999) and this accounts for 11 per cent of men's employment and 12 per cent of women's. Manufacturing employs 31 per cent of men and 27 per cent of women, with the rest employed mainly in commercial activities. Some analysis of the changes in the sectoral composition of employment shows that employment in local services has grown, especially for women. This sector has become the main job creation sector for women. The other notable feature of employment in Chile is a decline in manufacturing employment, though the percentage employed in manufacturing in this sample remains well above the percentage employed in countries of the European Union and in the United States (30 per cent in Chile versus 17 per cent in the European Union and United States). There is also evidence, based on the methodology suggested by Katz and Murphy (1992), that the shifts in employment and wages that have taken place since 1960 are mainly due to shifts in demand, especially in the periods associated with trade liberalisation.

Cross-country Evidence

The role of public-sector employment in economic growth was examined more formally in a cross-section of 54 countries by Berthélemy, Pissarides and Varoudakis (1999). The authors' claim is that human capital will be employed in activities where the private rate of return is maximised. Activities that offer high rates of return to the individual but which are not growth-enhancing are dubbed as "rent-seeking" activities. Rent-seeking activities may of course have many origins but most are associated with public policy distortions. The best way of testing for rent seeking is to identify the policy distortions and measure them for several countries (or use time series data for individual countries which experienced policy shifts). Rather than follow this approach, which would require the use of large amounts of resources and time, the authors make the assumption that the size of the policy distortions is directly proportional to the size of public-sector employment outside the education and health sectors. Data for this employment are readily available from World Bank sources. As an alternative, the size of the wage bill of the public sector (again net of the education and health sectors) as a proportion of GDP is also used as a proxy for the opportunities offered for rent extraction.

The Berthélemy *et al.* (1999) argument is that not all human capital stock in a country contributes to growth. The human capital employed in the administrative civil service does not, so if we remove that part of human capital from the total stock we should be able to get better estimates of cross-country growth regressions. The authors argue that the percentage of the human capital stock employed in the public sector is proportional to the ratio of public sector to total non-agricultural employment. The factor of proportionality is estimated as part of an aggregate production function. The regression ran is similar to the one ran by Mankiw, Romer and Weil (1992), based on the Solow growth model augmented by human capital. A fraction of human capital proportional to the ratio of employment in public administration to total non-agricultural employment is deducted from the factors of production. This introduces a new parameter to be estimated, the factor of proportionality. It is shown that the results are statistically superior to the ones reported by Mankiw *et al.*, who made no such correction. Results with the two alternative measures of rent-seeking opportunities, the size of employment and the size of the wage bill, are similar.

The improvement in the statistical properties of the estimated equation enables the authors to construct estimates of the loss of economic growth due to large public sectors. Dividing the sample into five regions with different relative sizes of public-sector employment, the following results are obtained (Table 4). The results are from the regressions with the level of employment in non-educational non-health-related public sector jobs as a proxy for the proportion of human capital lost in rent-seeking activities.

Table 4. Human Capital and The Growth Implications of Public Sector Employment

	Average years of schooling	Proportion of human capital in public sector	Estimated loss of GDP growth, 1985-95
OECD	9.0	20.6	5.1
Asia	5.2	19.8	4.9
Latin America	6.2	17.7	4.3
MENA	4.4	31.7	8.4
Sub-Saharan Africa	4.2	32.9	8.8

It is clear from the results reported that there can be substantial losses when the administrative public sector attracts a large fraction of labour. In the sample studied, the costs are particularly large in the two regions of the world where human capital is in shortest supply, the Middle East and North Africa Region and Sub-Saharan Africa. In these regions, the estimated cost from the large public sectors that each has is close to one percentage point of growth per year.

A related question that arises here is whether the loss of output identified in the estimates is pure redistribution. Many public sector activities contribute to social welfare but they do not contribute to technological advance and GDP growth. As George Borjas, the discussant of the Berthélemy *et al.* (1999) paper, points out, some of the public sector activities that are not measured in growth statistics still contribute to social output, as for example the work done by civil servants who issue driving licences or those engaged in the running of redistribution programmes. The methodology adopted in the Berthélemy *et al.* study cannot distinguish between rent seekers and those other kinds of activities.

VI. THE PRIVATE RETURNS TO HUMAN CAPITAL

Chile

Estimation of the private rate of return to human capital sheds light on the question of the incentives available to individuals to pursue education and training. A more ambitious approach to the estimation of the private rate of return, which it was hoped was to be discussed in the case studies, was the linking of the private rate of return to education to trade liberalisation and public or private sector employment. However, this proved difficult because of the unavailability of micro data before and after trade reforms. The only exception is Chile, where good micro data are available. Estimates of a coefficient of inequality in earnings (the gini coefficient) for Chile before and after trade liberalisation in the mid-1970s shows a sharp decline in inequality in the socialist period of 1972-74 but a sharp increase after liberalisation in 1975. Inequality increased until it exceeded the pre-socialist levels and remained higher until the early 1990s, when it declined again. By the mid-1990s, wage inequality was down to the levels that it was in the late 1960s and early 1970s. Moreover, this inequality pattern is typical of a variety of measures that can be computed (Gini coefficient, variance of the log of wages or the ratio of high to low percentiles).

Whereas wage inequality indices are highly correlated with the returns to education, in view of the fact that the high wages are usually earned by those with higher educational qualifications, explicit rates of return to schooling are more reliable where they can be computed. Chile is in the unusual position of having information on earnings from the same type of household survey since 1957. The information is annual and two indices have been computed by Bravo *et al.* (1999). First, the average earnings for cells with different levels of education qualifications and second Mincer regressions of the returns to one more year of schooling. Table 5 summarises some key findings.

Table 5. **Changes in the Returns to Education in Chile**

	1966-70	1971-75	1976-80	1981-85	1986-90	1991-96	1957-96
Average wage growth (a)	5.2	-15.3	8.1	-9.4	7.0	5.9	1.2
Wage growth diff. (b)	1.5	-7.0	2.3	4.1	5.2	-6.2	0.8
Rate of return to schooling (c)	11.8	10.8	13.5	14.4	15.0	13.7	13.2

Notes:

(a) average logarithmic change in real weekly wages;

(b) the difference of average logarithmic change in real weekly wages between those with university degree and those with incomplete high school;

(c) the coefficient on schooling in a "Mincer" regression (log earnings on years of schooling, experience and experience squared; male full-time wage earners).

The results in Table 5 tell a similar story. Real wages in Chile are flexible and have shown big swings, with a big fall recorded in the two recessionary periods, the first half of the 1970s and the first half of the 1980s. The period of trade liberalisation, the second half

of the 1970s, and the period of the large real depreciation, the second half of the 1980s, are periods of a fast rise in inequality and in the returns to schooling. The returns to schooling increase throughout the late 1970s and 1980s but fall in the 1990s. The absolute level of the returns remains high by international standards.

These results conform to the view that trade liberalisation favours skilled labour, namely that it is equivalent to an economic change that increases the rate of return to skilled labour relative to the rate of return to the unskilled. Of course, trade liberalisation continued into the 1990s when the rate of return to education began to fall. This, however, is to be expected because of adjustments in the supply of skilled labour. Initially, an increase in the relative demand for skilled labour increases its rate of return. Subsequently, more workers train in the required skills and the higher supply restores the rate of return to a new equilibrium level (which may or may not be the same as before the introduction of the reforms but it will not be lower).

The results from Chile confirm findings from other countries which show that trade liberalisation increases the private returns to education¹¹. The primary interest in this project was whether trade liberalisation also diverted human capital from public sector employment and rent seeking to growth-enhancing activities associated with trade and technological innovation. Unfortunately the latter was not tested directly but the results are consistent with that view, since the increase in the rate of return to education recorded is not associated with big wage rises in the public sector. In the 1980s, the size of the public sector declined and public sector spending decreased substantially.

India

In India trade liberalisation did not take place until the 1990s, and even after that the size of the country ensured that most activity remained inward. The research on the private rate of return for this study was conducted on a large data set (3 327 male workers) drawn from six large companies in 1986-87. These are all formal sector workers earning above a minimum that places them among the more educated section of the Indian labour force. The mean number of years of schooling for the sample was 11.63 years and their mean age 42. The availability of detailed information about the individuals in the sample enables the estimation of detailed earnings functions and rates of return to education.

The estimated mean rate of return to one year of schooling is 8.6 per cent, which exceeds the rate of return to one year of experience, 5.4 per cent at its highest. There are, however, variations across groups. College education is found to be more rewarding, with a rate of return of 9.3 per cent, compared with a rate of return of 7.4 per cent for high school. Engineering was a more rewarding vocation, with a rate of return of 11.7 per cent, compared with 8.1 for science, 5.5 for commerce and 4.5 for arts. Since the nature of the business of the companies that employed these workers is not known, it is not possible to tell whether the engineers and scientists provided a better match with these particular employers, but it is unlikely that rates of return would differ so much in one company and be comparable in others¹². An interesting finding of the study is that diplomas acquired by existing employees are rewarded, either with higher pay or promotion. So work training and the acquisition of new skills was encouraged by the companies in the sample.

Confidentiality (or other reasons?) precludes an analysis of the operations of the companies in the sample and their implications for the rate of return to education. Had this been possible, the richness of the sample could indeed shed some light on the questions

posed in this report. For example, if one company was engaged in export activities but another was not, some inference about the effect of export-oriented activities on the rate of return to education could be estimated. The link between the rate of return and the acquisition of new technology is another interesting issue that is not reported¹³.

Egypt

In Egypt, the survey used for the estimation of rates of return to education is the labour force sample survey of 1988. This survey covers all individuals employed during a reference year and reports information on net earnings (in the estimates for India it was unclear if earnings were net of tax). The sample is large (12 504 persons) and covers a large number of occupations and experience levels. The regression results reported, however, do not attempt to estimate an average rate of return to education function (along Mincerian lines) but report instead a comprehensive earnings function with occupational and regional variables and a comprehensive list of household characteristics. The net effect of education on earnings estimated is then the effect that remains after all other variables, which may be influenced by education, are controlled for. Thus, a person with more schooling may be more likely to enter certain occupations. If these occupations have a higher rate of return than the norm, earning regressions of the type reported in the paper will attribute the higher earnings to the occupational class of the person and not to his education. For this reason, the estimated returns to education in the report underestimate the rate of return to education.

With this in mind, the result that the rate of return to education is very small, and sometimes even negative, until university level is not an indication that qualified workers have wasted their education. Some interesting results emerge from the study, however. The average number of years of schooling of public sector workers is far greater than the average number of years of schooling of other workers. Yet, the rate of return to education in the public sector, however measured, is far below that in the private sector. This finding points to rent-seeking activity in the public sector, which is not reported in a survey that collected salary information. Despite the lower rate of return to education in the (formal) public sector, there are long queues to join it and it attracts highly qualified workers, whose rate of return outside, which is closer to a social rate of return, is higher¹⁴. Another interesting finding of the study is that the business cycle affects mainly new entrants to the labour force with primary education. Higher levels of education provide a cushion against low growth, as does experience in a society that gives a lot of benefits to incumbent employees.

Tanzania

Results for Tanzania come from two small surveys, both done in 1991 and supervised by the author of the report. One was a household survey in the country as a whole and covered 1 046 households. The other was a survey of 546 small enterprises (under 10 employees each) in five urban areas, covering both manufacturing and services.

Income in Tanzania is largely in kind, especially for rural workers. For this reason, and in the absence of a reliable estimate of the value of goods in kind in the household survey, instead of using reported income in the regressions use was made of reported expenditure. The simple Mincerian regression that yields estimates of the average rate of return to years of schooling and years of experience was estimated and the results indicated a very

high rate of return to education. If only the education of the head of the household is used, which is probably reasonable, the average rate of return to one year of schooling is 13.3 per cent and the maximum return to experience, before it starts declining with age, 9.1 per cent. When variables for location and some farm characteristics are introduced the rate of return to education drops to 10.2 per cent. Experiments with transformations of these variables gave even higher returns to education.

The information in the enterprise survey enabled the construction of hours of work, wage payments and payments in kind for each hour worked and the education and experience of each worker in each enterprise. It is also known if the enterprise is a family concern, employing close relatives. Earnings regressions were run by making use of this information and also information on the location of the enterprise (whether it was in the capital or elsewhere) and on the broad sector of activity. The number obtained in a variety of regressions for the mean return to one year's schooling was about 4 per cent, with experience adding another 2 per cent. Given that these enterprises were small and already differentiated from the bulk of employment in Tanzania (they were located in urban areas and their employees were already selected in part because of their educational qualifications), the estimated rate of return to education is large. Compared with the enterprises in the sample for India the rate of return is small, but in India the enterprises employed thousands of workers and offered internal opportunities for promotion, whereas in the small enterprise sample of Tanzania promotion usually required moving out of the sector. Even zero rate of return to education in this context would not be surprising. Overall, the results of the regressions indicate high returns to education in the economy as a whole and in the small enterprise sector.

The information available in the small enterprise sample enabled also the estimation of a cross-section production function for this sample. The results show that robust production functions can be estimated with coefficients that correspond to theoretical expectations. A representative estimate gives the coefficient on labour as 0.32, on capital 0.15 and on human capital 0.57. This shows a large contribution of human capital to the production of the firm. In other work with this sample, it was shown that the rate of return to capital in these enterprises was very high, exceeding 100 per cent. Combining this with the estimate on the contribution of human capital it shows that if qualified labour can acquire capital and start their own small businesses the social (and private) rate of return could be very high.

VII. EVALUATION AND POLICY IMPLICATIONS

The principal objective of this study was to investigate at the micro level the connection between human capital, growth and market regulation and liberalisation. Regressions at the aggregate level were also to be reported, to serve as benchmarks for the micro work. Although some questions about the empirical research remain unsettled, some conclusions and policy implications can be reached.

As with other work, at the aggregate level the studies are only suggestive of the influence of human capital on output and productivity. For developing countries the problem of distinguishing in aggregate regressions between different mechanisms by which human capital influences growth is compounded because of data limitations. It would be inappropriate to reach firm policy conclusions from the research at this level. In the one case where the data appear most reliable, India, the results indicate that a well-behaved production function with human capital acting to enhance TFP growth can be successfully estimated. If anything, the contribution of human capital in these estimates appears greater than expected. In Tanzania, where data imperfections do not allow precise estimates the results are consistent with the findings for India. But in the case of Egypt, the use of inappropriate series for employment casts doubts on the results. In the case of Chile, no comprehensive test of the influence of human capital on TFP growth was done, the emphasis of that study being the influence of trade liberalisation on growth.

The case of Egypt was studied by a number of authors and the conclusion generally is that the large expansion of education did not contribute to growth. The fact that productivity growth has been stagnant at a time of rapid expansion in education bears witness to that claim. So despite the caution that should be exercised in interpreting the results of the case study summarised in this report, the final results are not surprising.

One of the objectives of the project was to investigate whether there was any obvious connection between the liberalisation of trade, product and labour markets and the contribution of human capital to growth. Background to this claim was provided by the aggregate cross-section study of Berthélemy *et al.* (1997), which found that human capital contributes more to growth in economies that have liberalised trade and are open. Also, preliminary results from Chile and elsewhere, especially in South East Asia, encouraged thinking along these lines. Three of the four case studies could not test this claim. India liberalised in the 1990s, which is too recent for data availability; Egypt started a process of liberalisation in the mid-1970s but it was slow and still seems to be in a process of transition, and Tanzania is too poor and technologically backward to benefit from any process of liberalisation, which did not take place until the 1990s anyway. But Chile went through two major trade liberalisation episodes, the first in 1975-79, when quantitative restrictions were removed and in 1982-89 when the real exchange rate depreciated by over 100 per cent. Both periods, but especially the first, were associated with a fast rise in trade, a rise in the rate of productivity growth and a rise in the rate of return to human capital. Chile has good micro-based data that extends back to the late 1950s and these results are reliable. The fast rise in the rate of return to human capital is particularly important for the claims of this study since it is a clear indication that liberalisation of labour and product markets can enhance substantially the private rate of return to skills employed in private-sector activities.

The sectoral evidence considered points to the fact that distortions introduced by the public sector lie behind a misallocation of human capital. If the public sector offers the possibility of rent seeking, individuals with good education qualifications will be the first ones to take advantage of it. Once recruitment in public sector jobs is restricted (usually for financial reasons), either unemployment of qualified labour or migration and brain drain follow; unless there is domestic liberalisation at the same time, in which case qualified workers will find incentives to seek employment in the private sector.

These conclusions are based on the examination of three special cases so they should be treated with caution. But the stories that they tell have some common features. They are also in accordance with cross-country results, also done under the auspices of this project, which show that a measure of human capital performs statistically better in growth regressions when an estimate of the quantity of human capital employed in the public sector is deducted from the aggregate stock.

The studies have revealed large returns to education in the private sector. In Egypt, the rate of return to education in the private sector is higher than in the public sector, though some authors claim that the public sector still attracts educated labour because of the rent-seeking opportunities that it offers. In India, the estimated rates of return in a cross-section of large firms are very high, and so are in Tanzania at all levels. In Chile, during the liberalisation years the rate of return to education was even higher, exceeding 13 per cent.

Thus the private sector in the countries under study can afford to pay large premiums to qualified labour, justifying state subsidisation of education to overcome capital-market imperfections, even in the absence of precise estimates of the social rate of return to education. But if the state is to encourage the subsidised provision of education, it should concurrently ensure that opportunities for job creation in the private sector are not impeded by excessive regulation that creates rents for the “insiders”. Otherwise the insiders will reap the benefits in the form of higher wages and other payoffs and job creation will stagnate.

Opportunities for rent extraction by qualified labour can be found in a large public sector (excluding employment in the provision of education and health and social services) but also in private-sector jobs when there are strong unregulated trade unions or when there are firing and other stringent restrictions on employers in operation. The experience of both India and Egypt shows that subsidisation of education can lead to a large expansion of the human capital stock that is not accommodated by the economic system in the presence of regulatory restrictions. The situation seems to be especially acute in Egypt, where the type of education subsidised does not appear conducive to economic development. In India the subsidisation was for engineering and science degrees where rates of return to education are higher but there is still an over-supply of qualified manpower, as the long queues for unrelated public sector jobs testify. In these countries, the expansion of private sector jobs has been impeded either by a large protected public sector, as in the case of Egypt, or by excessive private-sector regulation of large firms, as in India. In the cross-country study of Berthélemy *et al.* (1999), it was estimated that the large size of the public sector in the Middle East and North African countries may have cost them as much as one percentage point of growth per year during the late 1980s and 1990s.

In contrast, the experience of Chile shows that if the economy is opened up to foreign competition, the rate of return to education can be very high, even for large stocks of human capital. This gives incentives for the diversion of qualified labour out of public

sector administration and into productive employment in the private sector. Chile liberalised trade mainly in the four years 1975-79, when many other regulatory restrictions on the private sector were removed as well. There followed a fast rise in productivity growth and very high rates of return schooling, which bear witness to the successful employment of skilled labour in growth-enhancing activities.

VIII. CONCLUDING REMARKS

The main policy implication that emerges from this study is that subsidised education without at the same time provision for the creation of growth-enhancing jobs can be good for the individual but bad for growth (and presumably public finances). There is evidence of very high *private* returns to education, in the form of higher wages for degree holders, but also evidence that these returns are not always matched by social returns in the form of higher output. Governments need to ensure that educated men and women have incentives to work in occupations that contribute to social welfare. Admittedly, some of those occupations, such as the running of social services or the looking after of sick people, do not show up in growth statistics. But they are as valuable as those that do.

Our research, which concentrated on growth, has shown that large administrative public sectors (excluding education, social services and health) give incentives for *rent extraction*. Educated workers can take advantage of the social position that a large uncompetitive public sector affords and employ their skills for the achievement of high returns for themselves, at the cost of others in society. Governments can help the growth prospects of their countries by restricting the size of their public sectors and making them more transparent.

Stringent employment protection, operated either by the legal system or by trade unions, also create opportunities for rent extraction by the “insiders” in large firms. Although the opportunities offered by large firms are not of the same nature as those offered by large public sectors, a firm which is not allowed by employees to restructure and adopt the latest technology, because of fear of the consequences for their jobs, cannot act as an engine of growth. Extensive legal protection gives employees opportunities of high private rates of return, removing the incentives that they may have to support the adoption of new technology.

On the positive side, liberalisation of trade gives incentives for skilled labour to engage in growth-enhancing activities, which increase both the private and social rates of return. Liberalisation can take the form of the removal of tariffs or the abolition of controls in foreign exchanges markets and in international capital movements. For developing countries, this is an effective way of ensuring that more advanced foreign technology is imported, either directly through FDI or indirectly. This can be an effective way of achieving fast “convergence” growth and rewarding skilled labour accordingly.

The conclusions that we have reached are tentative because of limited data. The possibility of collecting micro-data to study the relation between education and growth was the motivation behind this study. More can be done. We need to know for as many countries as possible the sectors that attract educated labour and the sectors that are leaders in the growth process. We have probably learned all we could from aggregate data. Sectoral data are badly needed: which sectors attract skills, what wages do they pay and how do they contribute to output growth? This study has pointed to labour market liberalisation — which increases the flexibility of employers eager to adopt new technology — and trade liberalisation — which gives incentives for such adoption — as key influences on the contribution of education to growth. For this reason, the sectoral data would be more useful for future research if it is from countries that underwent periods of liberalisation, or that have diverse institutions. Future research in this area will have to pay attention to institutional structures if it is to identify the mechanisms that maximise the contribution of human capital to economic growth and development.

NOTES

1. See Lucas (1988) for the most influential recent study in the theoretical literature. For a discussion of some recent theoretical models, see Barro and Sala-i-Martin (1995).
2. For a discussion of some early empirical attempts and a more optimistic approach to the issue than in the text see Benhabib and Spiegel (1994). Aggregate estimates are reported in Mankiw, Romer and Weil (1992), Barro (1991) and Barro and Lee (1993). For a panel data approach which fails to find a significant contribution of human capital, see Islam (1995). For a critical review of the empirical literature, which highlights its failures, see Pritchett (1996) and for a more up-to-date survey see Topel (1999).
3. See Gelb, Knight and Sabot (1991), Murphy, Shleifer and Vishny (1991) and Berthelemy, Pissarides and Varoudakis (1999).
4. See Berthelemy, Pissarides and Varoudakis (1999).
5. Berthelemy, Dessus and Varoudakis (1997) discuss the issues. For relevant literature, see Grossman and Helpman (1991), Rivera-Batiz and Romer (1991) and Pissarides (1997).
6. The study for this project, which contains all the information on India discussed here, is by Gupta and Saha (1998).
7. See Fergany (1998), prepared for this project.
8. See Sarris (1998), prepared for this project.
9. The report on Chile is by Bravo, de Gregorio and Larrain (1999).
10. These numbers are given in the report on India prepared for this project. The original source is the World Bank. Note that they are in terms of the entire population. See below for the share of public administration in employment.
11. See, for example, Hong Tan and Geeta Batra (1997) and Robbins (1995). Some other studies are summarised in Pissarides (1997).
12. In a competitive situation, rates of return to different skills should be equalised across employers.
13. See Hong Tan and Geeta Batra (1997).
14. See also Assaad (1997) for a thorough test of this hypothesis and an analysis of the implications of the public sector for employment in Egypt. According to Assaad (1997), when the earnings of public sector employees are properly measured, they are at least as high as those of comparable labour in the private sector and in some cases (as for qualified females) they are higher.

BIBLIOGRAPHY

- ASSAAD, R. (1997), "The Effects of Public Sector Hiring and Compensation Policies on the Egyptian Labor Market", *World Bank Economic Review* 11.
- BARRO, R. (1991), "Economic Growth in a Cross-Section of Countries", *Quarterly Journal of Economics* 106.
- BARRO, R. and J.-W. LEE (1993), "International Comparisons of Educational Attainment", *Journal of Monetary Economics* 32.
- BARRO, R. and X. SALA-I-MARTIN (1995), *Economic Growth*, McGraw-Hill, New York.
- BENHABIB, J. and M.M. SPIEGEL (1994), "The Role of Human Capital in Economic Development", *Journal of Monetary Economics* 34.
- BERTHÉLEMY, J.-C., S. DESSUS and A. VAROUDAKIS (1997), "Human Capital and Growth: The Role of the Trade Regime" mimeo, OECD Development Centre.
- BERTHÉLEMY, J.-C., C.A. PISSARIDES and A. VAROUDAKIS (1999), "Human Capital and Growth: The Cost of Rent Seeking Activities" in *Economic Growth and its Determinants*, edited by T. DE RUYTER VAN STEVENINCK, Academic Publishers, Kluwer, Dordrecht.
- BRAVO, D., J. DE GREGORIO and G. LARRAIN (1999), "Trade Reform and Growth: The Experience of Chile" mimeo, OECD Development Centre.
- FERGANY, N. (1998), "Human Capital and Economic Performance in Egypt" mimeo, OECD Development Centre.
- GELB, A., J.B. KNIGHT and R.H. SABOT (1991), "Public Sector Employment, Rent Seeking and Economic Growth", *Economic Journal* 101.
- GROSSMAN, G.M. and E. HELPMAN (1991), *Innovation and Growth in the Global Economy*, MIT Press, Cambridge, MA.
- GUPTA, I. and B. SAHA (1998), "Human Capital, Growth and Returns to Education: A Study for India" mimeo, OECD Development Centre.
- ISLAM, N. (1995), "Growth Empirics: A Panel Data Approach", *Quarterly Journal of Economics* 110.
- KATZ, L.F. and K.M. MURPHY (1992), "Changes in Relative Wages 1963-1987: Supply and Demand Factors" *Quarterly Journal of Economics* 107.
- LUCAS, R.E. (1988), "On the Mechanics of Economic Development" *Journal of Monetary Economics* 22.
- MANKIW, N.G., D. ROMER and D.N. WEIL (1992), "A Contribution to the Empirics of Economic Growth" *Quarterly Journal of Economics* 107.
- MURPHY, K.M., A. SHLEIFER and R.W. VISHNY (1991), "The Allocation of Talent: Implications for Growth", *Quarterly Journal of Economics* 106.
- PISSARIDES, C.A. (1997), "Learning by Trading and the Returns to Human Capital in Developing Countries", *The World Bank Economic Review* 11.
- PRITCHETT, L. (1996), "Where has all the Education Gone?" *World Bank Policy Research Paper* No. 1581,
- RIVERA-BATIZ, L.A. and P.M. ROMER (1991), "Economic Integration and Endogenous Growth", *Quarterly Journal of Economics* 106.

- ROBBINS, D.J. (1995), "Trade, Trade Liberalization and Inequality in Latin America and East Asia: Synthesis of Seven Country Studies" mimeo, Institute for International Development, Harvard University.
- SARRIS, A.H. (1998), "Human Capital and Growth in Tanzania" mimeo, OECD Development Centre.
- SOLOW, R. (1957), "Technical Change and the Aggregate Production Function", *Review of Economics and Statistics* 39.
- TAN, H. and G. BATRA (1997), "Technology and Firm Size — Wage Differentials in Colombia, Mexico, and Taiwan (China)" *World Bank Economic Review* 11.
- TOPEL, R. (1999), "Labor Markets and Economic Growth", in *Handbook of Labor Economics*, edited by O.C. ASHENFELTER and D. CARD, Amsterdam.