10 Capital–Skill Complementarity, Income Distribution, and Output Accounting (1975)*
with P. Fallon*

INTRODUCTION AND SUMMARY

How quickly do the returns to education fall when the number of educated people rises? This has been a crucial question for the philosophy of educational planning, since the case for manpower forecasting and planning is stronger the less easy the process of substituting educated for less educated people.

In answer to the questioning, Blaug (1967) and others pointed out that US rates of return to education had been remarkably constant over time despite a vast increase in the educated labor force. This suggested that substitution was relatively easy. Likewise, cross-sectional data on countries (Bowles, 1970) and on US states (Dougherty, 1972) showed that the relative wages of the educated tend to vary with their relative numbers by only small amounts – evidence again, it was claimed, of easy substitution.

However, the inference, whether from time series or cross-section, may not be valid if other things are varying at the same time. And the relative use of physical capital always varies, the ratio of physical capital to raw labour generally rising with the ratio of educated to raw labor. If physical capital is more complementary to educated than to raw labor, this could then explain why the relative wages of the educated are not much lower when their relative numbers are much higher. Equally, if this is the explanation, planners should avoid excessive educational expansion not accompanied by physical investment, since this could produce a rapid fall in relative wages.

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This ‘capital–skill complementary hypothesis’ has been advanced by Griliches (1969, 1970) and partially confirmed on a cross-section of US states. Because of lack of data, he assumed constancy across states in the absolute wage of educated manpower and in the rate of return on physical capital in any given industry. The present study relies instead on international data on 23 countries, including detailed information on national education-specific wages and data on physical capital stocks and rentals at the national, though not at the sectoral, level. The data have the advantages of wide variation but obvious problems of comparability. As regards the form of the relationships involved, Griliches restricted these by assuming constant own- and cross-elasticities of demand in each factor demand equation, while we restrict them by assuming an explicit form of production function – the two-level CES function.² This has the advantage, apart from yielding meaningful results, that we can use the explicit function to account for income differences between countries and for differences in the functional distribution of income.

The paper is constructed as follows. Section I examines capital–skill complementarity and the ease of substitution between types of labor at the level of the whole economy. The problem here is that factor prices affect educational choices as well as vice versa, and a complete model is therefore specified. Section II examines the same question at the sectoral level, factor prices being taken here as exogenous. Both sections I and II confirm the capital–skill complementarity hypothesis and suggest much lower elasticities of substitution between educated and raw labor than either Bowles or Dougherty. Sections III and IV revert to the whole-economy model. Section III illustrates how the production function, together with the relation determining the supply of educated people, determines the evolving pattern of income distribution as countries get richer (as measured by their total capital per head). If the supply of educated people is always such that the rates of return to education and to human capital are in fixed proportion, the parameters of the production function correctly predict that as economic progress occurs, human capital per head will grow faster than physical capital per head and the share of physical capital in national income will fall. In section IV we examine the relative importance of physical and human capital in explaining income differences between countries and conclude (contrary to the claims of Krueger, 1968) that physical capital is generally the more important.

I THE PATTERN OF SUBSTITUTION: WHOLE-ECONOMY LEVEL

The problem

Suppose there are only three factors of production, physical capital \((K)\), skill \((S – to be defined)\), and other labor \((N – to be defined)\), and output \((Y)\) is