ON THE APPROPRIATE MODEL FOR ANALYZING INVESTMENT IN HUMAN CAPITAL WHERE THE CAPITAL MARKET IS IMPERFECT

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This paper suggests a modification of the Becker–Chiswick model for analyzing investment in human capital where the capital market is imperfect. The modification essentially involves the addition of a consumption function to the model. As a result it is possible to include the effects of human capital investment on a student's income expectations, on consumption, and thereby on the availability of funds for the student to finance investment in human capital.

A model for analyzing investment in human capital in a situation where the capital market is imperfect has been presented by Gary Becker and Barry Chiswick [1], [2]. The essential elements of the model are a function which relates the rate of return on investment in human capital to its level and a function which relates the cost of funds borrowed to the volume of investment in human capital. Investment takes place until the rate of return is set equal to the marginal cost of borrowing.

The investment/earnings function can be written as

(1)
$$Y_t = f\left[\int_0^t I_i \, di, A\right]$$

where Y_t is the individual's earnings at time t, I_i is the amount invested in human capital during period i, and A is a shift parameter related to ability.[1] The cost of funds can be written as

(2)
$$r_t = g\left[\int_0^t I_i \, di, B\right]$$

This equation relates the marginal cost of funds for financing investment at time t (r_t) to the level of investment in human capital, and includes a shift parameter (B) to reflect differences in access to the capital market across individuals. The purpose of this note is to reformulate this model to include consumption as a source of demand for funds and to introduce the influence of part-time earnings.

The first step is to rewrite equation (2) as

(3)
$$r_t = g\left[\int_0^t (I_i + C_i - Y_i) \, di, B\right]$$

where C_i is the amount consumed and Y_i is gross income.[2] The second step is

[1]It is convenient here not to specify (1) in terms of the rate of return, as in Becker [1].

[2]Of course, if ($C_i - Y_i$) is zero through period t, then the Becker–Chiswick specification of the cost of funds would be identical with (3). This is equivalent to assuming that differences in student consumption associated with differences in ability to earn post-schooling income will be accompanied by equal and offsetting differences in student part-time earnings.

to include a function which specifies consumption at time t (C_t) for any individual as determined by the time path of earnings and the cost of borrowing, or

$$(4) \qquad C_t = h\left[\int_0^n j(Y_i, r_i)\, di, t\right]$$

where j is the appropriate function for discounting income at the variable rate of interest r_i for an individual who will live to age n. The parameters of h and j are also determined in accordance with the individual's time preference.[3]

Dependence of consumption on current and expected future income implies that differences in earning ability will in general lead to differences in desired current consumption levels. Variations in desired consumption will, in turn, affect borrowing for purposes of consumption through (3), thereby affecting the marginal cost (availability) of funds borrowed for investment. The Becker–Chiswick model, not containing a consumption function such as (4) nor including borrowing for purposes of consumption as a potential source of demand for funds, is not equipped for analyzing the decision to invest in human capital where consumption is a function of income expectations.[4]

Evidence on the Determinants of Student Consumption

A revision such as the one suggested here is important only if desired student consumption is systematically affected by earnings expectations so as to cause those with expectations of higher earnings to borrow more while in school in order to finance additional consumption. Or, if the supply of funds is relatively inelastic, those with higher expected earnings might revise their investment-consumption mix toward greater relative consumption without further borrowing.

Evidence on the determinants of the consumption of a sample of graduate students is presented in Gustman and Stafford [4]. There, past and current income and net debt constant, student consumption was found to vary positively with income expectations.[5] Graduate students planning to work for the higher paying research organizations were found to spend $300 or 8 percent more per year than those planning to work for state and local governments, which are generally lower paying (Tolles and Melichar [7]). Further, age-earnings profiles of those in the

[3]Hirshleifer [5] has demonstrated that in the general case, one must consider time preference in analyzing investment and consumption decisions in the setting of an imperfect capital market. Becker's implicit assumption that a particular student's consumption does not vary with his income expectations is equivalent to an assumption of right angled indifference curves between current and future consumption, with the points of intersection for the vertical and horizontal components of the indifference curves falling along a line perpendicular to the current consumption axis at some fixed level of current (student) consumption.

[4]It should be noted that Becker does list foregone consumption as one source of funds which may be tapped to finance investment in education. This source of funds is said to represent a high cost segment of the cost of funds function [1, p. 10]. However, he does not treat consumption as continuously varying with the cost of funds, or with the volume of expected earnings. Also, he does not treat consumption as a source of demand for funds which continuously varies in relation to investment demand, as the returns to investment and the cost of funds vary.

[5]Other factors which are "held constant" in the regression analysis include marital status, number of children, hours per week in academic study and physical wealth.

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labor force as indices of expected income exhibited systematic effects on graduate student consumption as specified by equation (4).[6]

IMPLICATIONS OF THE ANALYSIS

With regard to estimating the returns to education, a major implication of the model contained in equations (1), (3) and (4) has been stressed by Becker [1]. That is, if the capital market is imperfect then most widely cited estimates of the rate of return, which are generally based upon a single equation model similar to equation (1), are probably biased. In addition, an implication of the above analysis is that if one were to estimate the returns to education using the Becker–Chiswick model, the resultant estimates would also be biased.[7] For example, a change in earnings expectations which is reflected in an increment to the error term of the earnings function will lead to a change in consumption, which in turn will alter the funds available for investment and thereby affect the error term of the cost of funds equation. The result is that the error terms of the two equations will not be independently distributed; rather, they will vary together reflecting the influence of the consumption effect.

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[6]For additional evidence consistent with the revised model see Watts [8].

[7]If a student's post-graduate earnings expectations should happen to be reflected in his wage for after school or summer employment, this will act to offset the effect of income expectations on loan demand. However, it is doubtful that any increment to the part-time earnings of a more able student will exactly match the increment to his consumption while in school. Therefore, in general, a model such as the one specified in equations (1), (3), and (4) must be employed in analyzing the decision to invest in human capital in the setting of an imperfect capital market.