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by
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Positive Differentials Between Interest Rates
for Borrowing and Lending:
Implications for Investment in Human Capital*

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Introduction

A basic institutional fact is that individuals face an interest rate for borrowing that exceeds that at which they can lend. Abstracting from risk, that it is efficient to carry out such transactions through financial intermediaries that do not produce at zero cost makes this spread inevitable.

This paper imposes this interest rate structure on a simple human capital model. Focussing on individuals who are not net savers during the period in which schooling occurs, it is shown that the consequences of the existence of this interest rate differential provide straightforward and reasonable explanations for four widely observed phenomena:

a) that most students are neither net borrowers nor lenders during the schooling period, typically financing consumption via summer or part-time employment;

b) that the estimated rate of return to schooling almost invariably exceeds the rate of return on relevant alternative investments;

c) that increased unearned income augments investment in human capital; and

d) that more able individuals appear to have greater access to capital markets during the schooling period.

The analysis does not require anything that one could reasonably call a capital market imperfection. (a)-(d) have frequently been approached from that direction. However, in view of recent work on the role of parental resources in the human capital accumulation process, analyses based on such imperfections seem increasingly artificial.¹ This paper shows that while capital market imperfections may be sufficient, they are not necessary for the understanding of (a)-(d).

Without apology, the analysis is carried out diagrammatically and in a two-period framework. The extension to more complex cases is straightforward.
A Basic Model

The model to be analyzed below is a variant of the following human capital model. Individuals live for two periods and seek to maximize lifetime utility, a monotone-increasing quasi-concave function defined over consumption in each of the two periods \((C_1, C_2)\). Each individual possesses a stock of wealth \(W\), and borrowing and lending at the fixed interest rate \(r\) is permitted.

Human capital is accumulated through schooling, the costs of which are assumed to be solely in terms of the value of working time foregone. If no schooling is undertaken, the individual has labor income equal to \(\tilde{y}\) each period. The investment process is summarized by the function \(y_2 = g(y_1)\) where \(y_t\) represents income at time \(t\), \(g' < 0\) and \(\tilde{y} = g(\tilde{y})\).

Given the investment and borrowing-lending opportunities, the solution to the individual maximum problem is presented in Figure 1, which is drawn for an individual who is a net borrower in period 1. \(y_1^*\) and \(y_2^*\) are chosen to maximize life wealth \(W^* = y_1^* + y_2^*/(1+r) + W\). This involves investing up to the point at which \(g' = -(1+r)\). \(C_1^*\) and \(C_2^*\) are chosen to maximize utility subject to constraint \(C_1^* + C_2^*/(1+r) = W^*\), which is accomplished by choosing \(C_1^*\) and \(C_2^*\) such that \(U_{C_1}/U_{C_2} = 1+r\). Income generating activities are separated from consumption activities.

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Figure 1
Equilibrium Under Different Interest Rates for Borrowing and Lending

The modification to be introduced into the model is to assume that the interest rate the individual faces for borrowing, \( r_B \), exceeds that for lending, \( r_L \): \( r_L < r < r_B \).

The addition complicates construction of the individual's consumption opportunity set. Consider Figure 2. The line BA has slope \(-(1+r_B)\), while DC has slope \(-(1+r_L)\). The segment BC is \( g(y_t) \) shifted horizontally by the amount \( W \). The curve DCBA is the opportunity set.

OA represents \( W \) plus the present value of life earnings. All resources have been transferred to period 1 by choosing the human capital configuration that maximizes the present value of future earnings (using \( r_B \)), and then borrowing against them. How should the individual reallocate resources to period 2? He can either reduce borrowing against future income or lend a portion of \( W \). Reductions in borrowing yield a greater marginal increase in period 2 resources. Accordingly that route is taken. AB represents the \((C_1, C_2)\) pairs made available. At point B, all borrowing against future income has ceased and further reallocations to period 2 are affected by increasing the stock of human capital, which has a rate of return in excess of \( r_L \) over the region CB. Finally at point C, the period 2 value (at rate \( r_L \)) of life earnings is maximized and further reallocations to period 2 are carried out via lending at rate \( r_L \).

Given the consumption possibility set, the individual maximizes utility by choosing \( C_1^* \) and \( C_2^* \) so that his indifference curve is tangent to the boundary of the set.

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Figure 2
Figure 2 also depicts the equilibria for individuals who would be net borrowers if \( r_L = r = r_B \).

For individual 1, who continues to borrow at the new rate \( r_B \), the situation \( r_L < r < r_B \) is identical to a rise in the interest rate. Investment in human capital is chosen to maximize the present value of life earnings.

Individual 2 ceases borrowing entirely. The reduction in investment in human capital is much smaller than would have occurred had a unique interest rate risen. The reason is that \( r_L < r < r_B \) imparts an ordering to methods of transferring resources over time. For individual 2, investment in human capital is the marginal method. Generally speaking, \( r_L < r < r_B \) generates a closer correspondence between income and consumption.

**Implications**

An often cited "fact" is that post secondary school students frequently neither borrow nor lend (in the sense of having positive savings at the conclusion of schooling), instead financing their consumption using summer earnings. This is frequently explained with reference to either imperfect capital markets (in the sense of non-constant marginal borrowing rates or fixed amount constraints) or the fact that human capital makes poor collateral (implying the "illiquidity of human capital relative to physical capital").

The analysis above suggests the simpler explanation that many individuals may locate on CB in Figure 2 whereupon investment is the marginal method of transferring resources over time. \( r_L < r < r_B \) does not conform well to what one would call an imperfect market, for individuals can borrow or lend as much as desired at fixed interest rates. Moreover, differences between \( r_L \) and \( r_B \) confront all individuals, including those who invest in physical capital. That students frequently do not borrow or lend is not evidence of severely imperfect capital markets.
Two other observations that have received a good deal of attention are that (a) rates of return to schooling appear consistently higher than rates of return on alternative non-human means of shifting resources to the future, and (b) that increases in unearned income lengthen the schooling period.

In the present context, the marginal impact of schooling on income will, for individuals who are not net savers in period 1, always exceed \( r_L \), the relevant interest rate for transferring resources forward to period 2 through non-human channels. Observation (a) follows naturally from the model, at least to the extent that estimated rates of return do not regularly exceed \( r_B \). This seems plausible if \( r_B \) is viewed as being of the nature of a typical interest rate on loans for consumer durables.

The impact of unearned income follows naturally as well. Turning to Figure 3, increasing \( W \) shifts the constraint to the right. Assume \( C_2 \) is normal. Some individuals who were previously choosing investment to maximize the present value (at rate \( r_B \)) of life income and then borrowing, will shift to no borrowing and a greater investment in human capital. Those who were already neither borrowing nor lending will also choose a larger level of investment. The reasoning is straightforward. Greater \( W \) implies larger \( C_2 \). If investment in human capital is the marginal method of transferring resources, investment will rise. If investment is not the marginal method, increased \( W \) may cause it to become the marginal method.

Figure 3
Finally, those individuals who are more able (in the sense of acquiring more human capital for a given input) face a \( g(y_1) \) function that emanates from the point \((\bar{y}, \bar{y})\) in Figure 1, but is steeper than that confronting the less able. As the reader can readily verify, this elongates the section AB of the constraint (Figure 2) and makes it more likely that the more able individual will be a net borrower in period 1. That is, ex post it will appear as if more able individuals have greater access to capital markets.

**Conclusion**

The introduction of a differential between rates of interest for borrowing and lending generates a natural hierarchy of methods of transferring resources through time. In particular, transferring resources solely via varying the extent of investment in human capital becomes rational over a certain range. The hierarchy and specialization provide straightforward explanations for several widely observed phenomena that are typically approached from the viewpoint of imperfect capital markets.
Footnotes

1See Becker and Tomes.

2For simplicity it is assumed that $g'(y) = \infty$ and $g'(0) = 0$. This guarantees an interior solution for the optimal level of investment.

3Of course, if $r_L = r_B$, borrowing less and lending more are identical so this distinction does not arise in the basic model.

4This abstracts from special inducements to borrow such as government guaranteed education loans.

5For a survey of explanations of this empirical result see the author.

6This result may also be explained by supposing that capital market imperfections decline with unearned income (Becker); or that human capital is a risky investment and that individual preferences display declining absolute risk aversion (Levhari and Weiss).

References


Note: $I_i$ refers to the indifference curve of individual $i$ when $r_L = r_B$.
$I_i'$ refers to the indifference curve of individual $i$ when $r_L < r_B$. 