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Real options and human capital investment

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Abstract

This paper extends the standard human capital model with real options. Real options influence investment behavior when risky investments in human capital are irreversible and individuals can affect the timing of the investment. Option values make individuals more reluctant to invest in human capital and, as a result, required returns on the investment increase. Real options may help to explain a larger human capital premium for higher education, smaller responsiveness of higher educational investments to financial incentives, and larger sensitivity of higher educational investments to low-return outcomes and human capital risks. Higher tax rates (or lower subsidies) depress human capital investments, but to a lesser extent than in the standard human capital model if not all direct costs are tax-deductible. A flat income tax remains neutral if education expenditures are fully deductible.

JEL classification: G1; H2; I2; J2
Keywords: Human capital; Higher education; Risk; Irreversible investment; Real options; Progressive taxation; Education subsidies

1. Introduction

> "The long time required to collect the return on an investment in human capital reduces the knowledge available, for knowledge required is about the environment when the return is to be received. […] The desire to acquire additional knowledge about the return and about alternatives provides an incentive to postpone any risky investment […]." Becker (1964, pp. 91–92, 94).

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Observed returns to human capital are typically larger than the risk-free rate as Palacios-Huerta (2004, 2006) has shown in a novel finance approach. High returns are also consistently found in the empirical labor literature (Card, 1999; Ashenfelter et al., 1999; Harmon et al., 2003). This begs the question why the private returns to education are so high. Capital markets may not make sufficient borrowing available due to enforcement and information problems (Stiglitz and Weiss, 1981). Liquidity constraints increase required returns on human capital. The empirical plausibility of liquidity constraints is controversial, however. Carneiro and Heckman (2003), Cameron and Taber (2004), Plug and Vijverberg (2004) and others find that liquidity constraints only have a slight impact on enrolment in higher education and seem to be insufficient to explain high observed rates of return to education.[1]

Income risk may also justify a high rate of return. Risk averse individuals want to be compensated for income risks. Indeed, Palacios-Huerta (2004, 2006) finds that human capital returns include a substantial risk premium. Many papers find evidence for risk compensation in wages, see the overview by Hartog (2005). Nevertheless, the high return on human capital is suggestive of a human capital premium puzzle, just like in the finance literature (see e.g., Mehra and Prescott, 2003). Palacios-Huerta (2006) has shown that risk alone cannot explain the difference between the real return on human capital and the risk-free interest rate. Only implausibly large coefficients of relative risk aversion, ranging from 30–60, generate a risk-premium on human capital investments that is consistent with the data. Judd (2000) argues that, if idiosyncratic income risks are so important, governments or markets would look for institutions to insure these risks. Apparently, neither is the case. Both private and public insurance are not likely to emerge if moral hazard renders the income risks endogenous rather than idiosyncratic, see also Judd (2000) and Sinn (1995).

Another empirical puzzle is that the covariance between earnings or employment and the marginal investment in education appears to be negative, see also Gould et al. (2000), Hartog and Diaz-Serrano (2002), and Belzil and Hansen (2004). Also, Palacios-Huerta (2004, 2006) empirically finds that the human capital premium is lowered as workers become more educated. This suggests that, although human capital investment is risky on average, higher levels of human capital hedge against labor market risks on the margin, cf. Levhari and Weiss (1974). Rubinstein and Tsiddon (2001) show that the negative correlation between education and unemployment or earnings risk vanishes, once controls for parental education are included in the analysis. Earnings and unemployment risks could then be driven mainly by parental or even genetic transfers of skills, rather than market risks. Indeed, Cunha et al. (2005) demonstrate that a large part of risk in labor market outcomes can be traced back to non-observed heterogeneity, not to market risk. These empirical findings also substantially weaken the case for a substantial risk premium for human capital investments.

This paper demonstrates that real options could provide another explanation as to why returns are high for higher educational investments. Real options are present in irreversible and risky investments in which there is a possibility to influence the timing of the investment. Human capital is generally regarded as a non-liquid asset (e.g., Friedman, 1962). It is impossible to recover forgone earnings and tuition expenses by selling the asset after the investment has been made. Investments are therefore sunk. Individuals can, however, influence the timing of the decision to invest in risky higher education. They have an option to wait for better information regarding the returns (or costs) of the investment. If they invest immediately in higher education,

[1] Palacios-Huerta (2006) suggests that borrowing and solvency constraints may explain up to fifty percent of the human capital premium if these were indeed the main frictions in the capital market.