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Higher education funding: The value of information

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HIGHLIGHTS

- I examine the welfare implications of improvement in public information.
- Agents choose how to finance their higher education based on a signal about individual skills.
- More information (more accurate signals) makes economic agents worse off.
- More information reduces participation in risk sharing arrangements and harms the borrowing terms.
- More information destroys insuring against "rainy days" and aggravates adverse selection.

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ABSTRACT

This note examines the key role of information about individual skills in economic welfare. In the model, agents invest in higher education when the returns to their investment are uncertain. They choose how to finance their investment on the basis of a public signal about their individual skills. This note provides an example of an economic framework in which, in equilibrium, more information about individual skills (more accurate signals) makes economic agents worse off.

1. Introduction

I analyze the crucial influence of information about individual skills on students' funding decisions and, thus, on their economic welfare. The issue of funding higher education is an ongoing world-wide debate. Many countries have recently shifted from public higher education funding (through income support transfers) to private funding (through student loans). Thus, decisions about how to finance higher education (referred to as "funding decisions" hereinafter) have become an individual choice in terms of student loans. Facing intrinsic uncertainty about their future human capital, students' funding decisions are subject to information. Focusing on funding decisions, this note provides an example of an economic framework in which, in equilibrium, more information about individual skills makes economic agents worse off.

This note considers the following framework: risk-averse agents born with random innate ability. Each agent, before entering the higher education system, receives a public signal correlated with the true realization of his or her innate ability. The agents use the signal (e.g., their mean high school achievements) to choose how to finance their higher education. All agents have a quadratic utility function. In the model, more information means better screening with respect to individual abilities (more accurate signals). Prior research has extensively investigated the effect of more information on both micro-economic and macro-economic behavior. It is well-known that more public information can harm individual decision makers in a wide range of circumstances (e.g.,

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Green, 1981; Schlee, 2001).[1] Eckwert and Zilcha (2004, 2010) were the first to assess this finding in a higher education model. In line with Eckwert and Zilcha, I show that more information (more accurate signals) destroys the risk-sharing opportunities in the economy. However, while their studies focus on investment (effort) decisions, I highlight the "value of information" in a completely different channel—namely, funding decisions.

I model funding decisions as follows. Students are allowed to diversify their funding through two common funding channels: credit market loans (CMLs), which impose a fixed interest rate on all students, and income-contingent repayment loans (ICLs), in which paybacks depend on future labor market incomes. Students with larger income realizations (known after they complete their higher education) incur larger paybacks than those who have lower income levels. Therefore, ICLs provide "insurance" (risk sharing) against the uncertainty in future labor incomes.[2] All students self-finance their higher education by choosing their own portfolio of both funding channels.

In this framework, this note examines the welfare implications of improvement in information. The welfare gains (in terms of *ex ante* expected utility) from the ICLs-program depend on the borrowing terms, which hinge on the size of the participating group in these arrangements. Each agent determines his or her optimal portfolio of loans by maximizing the expected utility conditional on the signal he or she received. More information, in terms of precision of the signals, affects the group size of students using the ICL program and, thus, their borrowing terms and their welfare.

I derive two key insights. First, ICL participants are adversely selected. That is, students with poor income prospects are more likely to choose ICLs than those with favorable income prospects, which worsens the borrowing terms and reduces the attractiveness of the ICL program. Consequently, promising students further depart to CMLs to reduce their repayments, which pushes the financing costs of ICLs even higher. Second, noisier signals, in terms of screening students' abilities, alleviate the adverse selection. As the signals become noisier, promising students increase borrowing through the ICL program as a risk-sharing tool, which improves the borrowing terms for all ICL participants. Consistent with Hirshleifer (1971), revealing more information destroys the possibility of insuring against "rainy days". Better screening introduces risk from an *ex ante* perspective, because agents cannot insure against risks that the signals had already resolved. Therefore, more precision of signals results in lower economic welfare.

This note continues as follows: Section 2 introduces the model. Section 3 derives a closed-form solution for funding decisions. Section 4 reveals the value of information, and Section 5 concludes. Unless otherwise mentioned, proofs are relegated to Appendix.

2. The model

This section briefly depicts the model's essential basics: timeline, human-capital formation, higher education funding, individual behavior, and the value of information. Hatsor (2014) provides a thorough description of the model, including the production sector and the equilibrium.

[1] For example, the industrial organization literature emphasizes the smoothing effect of uncertainty. In Morris and Shin's (2002) beauty-contest game, the key factor is a coordination motive, which induces overreaction to more information.

[2] Several countries implement ICLs, including Chile, Sweden, New Zealand, and the United Kingdom. Chapman (2006) describes the experience in Australia, the first country to establish ICLs. Eckwert and Zilcha (2012) analyze alternative ICLs that differ in the degree of risk pooling.

2.1. Timeline and human-capital formation

The lifetime of agents contains a youth period and a working period. A continuum of agents $[0, 1]$ is randomly endowed with innate ability. Although the individual ability is still unknown, the ability distribution is exogenously given. Therefore, there is no *aggregate* uncertainty in the economy. Then, agents acquire compulsory public education (K-12), which gives them a basic level of human-capital A. After secondary education, they receive a public signal, $y \in \left[y^1, y^2\right] \subset R_+$, with the distribution $\nu(y)$. I denote all agents with signal y as signal-group y and their ability at this point as a realization of a random variable, $\tilde{a}_y$. Assumption 1 simplifies the analysis:

Assumption 1. $\tilde{a}_y = y + \tilde{\varepsilon}$, and $\tilde{\varepsilon} \sim (0, \sigma^2)$. ○

By definition, the signal reflects the expected ability in signal-group y, which is

$$\bar{a}_y = E\left[\tilde{a}_y\right] = y. \tag{1}$$

Therefore, larger signals represent "good news" because they forecast higher expected ability. Blackwell (1953) proposed a criterion to compare information systems. An information system becomes less informative by adding some random noise (randomization) to the system. Accordingly, I define "informativeness" as follows:

Definition 1 (*Informativeness*)**.** The variance σ^2 measures the signals' noise (quality/accuracy). As the variance declines, the signals become more informative (in terms of screening abilities). That is, agents gain "more information" about their actual ability.

Given their signal, agents choose whether to invest in higher education ($I = 1$) and upgrade their level of human capital to $A+\tilde{a}_y$ or not ($I = 0$). When students complete higher education, their abilities are fully revealed. Then, in the working period, their labor income equals their human capital multiplied by the wage rate of an effective unit of human capital, ω. After repaying their student loans, they use the rest of their income for consumption.

2.2. Higher education funding

At the outset of their higher education, students diversify their loans between ICLs and CMLs. The payback R of CMLs is exogenously given by the gross international interest rate. In contrast, the ICL payback, $R\frac{\tilde{a}_y}{\bar{a}}$, depends on the realization of ability and on $\bar{a}$, which is a plug-in number that enables both loan programs to break even without government funds. Accordingly, high-signal ICL participants, with $\bar{a}_y > \bar{a}$, are expected to cross-subsidize the remaining participants (because their expected repayments, $R\frac{\bar{a}_y}{\bar{a}}$, are larger than the interest rate).[3] Mixing the two loans, the random payback of signal-group y is

$$\theta_y R + \left(1 - \theta_y\right) R\frac{\tilde{a}_y}{\bar{a}}, \tag{2}$$

where $\theta_y \in [0, 1]$ is the CML share and $1 - \theta_y$ is the ICL share in the portfolio. The government designs the loan programs to break even by equating the *expected* paybacks *across all signal groups* to the interest rate,

$$E\left[\theta_y R + \left(1 - \theta_y\right) R\frac{\bar{a}_y}{\bar{a}}\right] = R. \tag{3}$$

[3] Recall that students repay their loan after abilities are fully revealed. Therefore, high-signal ICL participants will indeed cross-subsidize others if their actual ability (not their signal) is larger than $\bar{a}$.