THE ROLE OF FAMILY TIES FOR THE OPTIMAL DESIGN OF HUMAN CAPITAL CONTRACTS

Caroline Flammer, Kean University

ABSTRACT

This paper studies the problem of financing a child's primary education when the parent is faced with credit constraints, contracting with minors is not possible and the legal enforceability of contracts is limited – a profound problem in many developing countries. It presents a model in which the empathy of agents towards their kinship ("family ties") is endogenized and self-enforcement of contracts is guaranteed through the interlinkage of credit markets – first a market for education credits, then a market for personal credits such as microcredits. We analyze the impact of increased mobility and anonymity observed in developing societies on the optimal contract design and allow for imperfect information. The main results are as follows: a decrease in information flow (regarding traceability of the whereabouts as well as borrowers' credit history) causes the interest rate of the education credit to always decrease, while the effect on the interest rate of the microcredit is ambiguous. The latter falls if the parent's empathy towards its child is independent of the child's empathy. Furthermore, we find that family ties not only represent an insurance for the family members against financial distress but can also dampen the negative effect of limited enforcement on the lender's payoff.

JEL: D64; D86; I22; O12; O16

KEYWORDS: Enforcement, Microfinance, Credit Markets, Education, Human Capital, Empathy.

INTRODUCTION

A profound problem of many developing countries is that access to primary education as well as (legal) enforceability of contracts are limited. This paper addresses both issues and designs a contract that is self-enforcing and promises to improve access to primary education without relying on traditional collateral or contracting with minors.

Even today, children from poor families often have limited or no access to primary education, not so much because of direct costs like school fees but mostly because of insurmountable indirect costs. These costs include, for example, tuition fees, school materials, uniforms, transportation and lost earnings. Instead of attending school on a daily basis, children typically work in order to make a living. The lack of means makes borrowing vital in order to pursue an education. However, poor families hardly qualify for credits from conventional banks due to a lack of (traditional) collateral and eligible guarantors.

The only remedy is often seen in microfinance, which neither relies on traditional collateral nor legal enforceability of contracts but on alternative mechanisms in order to guarantee the self-enforcement of contracts. For example, social pressure as well as the threat of confiscating personal belongings is used in order to enhance compliance. The belongings might be of only little market value but their subjective value, which is most decisive, can be excessively high. A further highly effective instrument is dynamic lending, i.e. the promise of a continuing business connection for complying borrowers, where credit is increased over time (for an overview of instruments, see, e.g., Armendàriz de Aghion and Morduch, 2004, 2005; Ledgerwood, 1999; Morduch, 1999).

Microfinance institutions (MFIs) provide a wide range of services to individuals – or groups of individuals – in order to support and consequently help them out of poverty. The best-known service is

providing credit to poor households and small enterprises, the so-called microcredit. However, the common practice of microfinance institutions has not focused on education so far. Up to now, microfinancing has only linked microcredits with education insofar as some MFIs provide financial together with educational services at periodically conducted meetings (see, e.g., Dunford, 2001, 2003; Dunford and Denman, 2001; MkNelly and McCord, 2001, 2002, 2003).

In practice, various forms of education financing schemes exist. Nevertheless, the focus of government practices has been mainly on supply-sided financing schemes attempting to improve the supply of education (e.g., the quality of education, performance of students) and not the access to education for children from poor backgrounds. This deficiency of supply-sided financing schemes has been (at least partly) remedied by demand-sided financing schemes which can be divided into cost-recovering and non cost-recovering financing of education depending on whether it is the student herself, as the main beneficiary of education, or others – such as the government, and hence the tax-payers – who ultimately pay for education.

Demand-sided financing schemes have received increasing attention in recent years in practice as well as in the academic literature. However, existent demand-sided financing schemes are either financially not sustainable or have only been concerned with improving access to *higher* education. Hence, there exists a gap not only in policy implementation but also in academic literature regarding the sustainable financing of primary education in developing countries.

An inherent feature of cost-recovering financing of primary education is that the main beneficiary is minor and therefore not allowed to contract. This paper contributes to the current literature by introducing a "three-person relationship" where the lender closes an "education contract" with the parent instead. Precisely, this education contract comprises, on one hand, a microcredit for the contracting partner's own production. On the other hand, it includes an investment into the education of the borrower's child. While some interest is paid on the former, the latter is interest-free and does not have to be paid back.

Contracting partners are only the investor and the borrower, while the child is not bound to do anything. However, it is assumed that the child shows some gratitude to his parent for becoming educated and escaping extreme poverty. This gratitude is expressed through a monetary transfer to the parent in the future. The empathy of the parent towards his child, in turn, is induced by the anticipated gratitude of the child. (Note that the parent's and child's decision-makings are formalized as optimization problems in which altruism is not exogenously imposed but arises as a response to (anticipated) actions.) This paper focuses on the case when the lender disposes of the absolute bargaining power. Consequently, it is the lender who determines the optimal contract design, which crucially depends on the parent's empathy, while the child optimizes his transfer on the basis of his own empathy.

The self-enforcement of the education contract is guaranteed by introducing an interlinkage between the market for education financing and the successive credit market (e.g., microcredit, mortgage, etc.). The threat of having no (or only limited) access to the credit market enhances the borrower's compliance with the education contract. As experience with interlinkages between the markets of land, labor and credit shows, this feature allows for investment in countries where (legal) contract enforcement is limited.

One key contribution of this paper is the analysis of the effect of increased mobility and anonymity in developing societies on the optimal terms of the interlinked contracts depending on the strength of family ties. We find that a worsening in contract enforcement always leads to a decrease in the interest rate on the education credit while the effect on the interest rate of the microcredit in the second phase is ambiguous. Nevertheless, we find that a decrease in information flow causes the interest rate to fall if the parent's caring for its child is independent of the child's gratitude. A further finding is that a deterioration

in contract enforcement causes the interest rate on the microcredit to decrease less when family ties are tight than when family members are only concerned about their own welfare. If, however, the child's gratefulness exceeds a rational level – that is when the child attaches greater importance to the welfare of his parent than his own – then a worsening of contract enforcement has the opposite effect. In this case, an increase in mobility and anonymity leads to a stronger decrease in the interest rate of the microcredit when family ties are tight than when the parent is more individualistic.

The main contribution of this paper is that – even in countries where i) a legal system guaranteeing the enforcement of contracts is missing, and ii) information flow (regarding traceability of the whereabouts as well as borrowers' credit history) is limited – the enforcement of "education contracts" is possible. In other words, this financing scheme potentially represents an alternative approach for sustainably financing primary education, without relying on the legal enforceability of contracts, traditional collateral or contracting with minors. It must be noted, however, that even though "education contracts" are self-enforcing regardless of information flow, the latter determines the contract design and might prevent the closing of a contract in the first place. Precisely, as information flow worsens and consequently interest rates fall, the lender becomes less willing to close a contract at all. To the best of our knowledge, this is the first paper that establishes these results (and actually addresses the issue of sustainable financing of education in developing countries altogether).

The rest of this paper is organized as follows. In Section 2, we briefly discuss the relevant literature. In Section 3, a theoretical model is presented and its implications are discussed. In Section 4, we analyze the effect of a worsening in contract enforcement (e.g., due to a decrease in information flow). Section 5 summarizes the main findings and concludes.

LITERATURE REVIEW

In academic research, the literature on education financing schemes is ample. But, just as in practice, demand-sided financing has been neglected for a long time, even though it can be traced back to the pioneering work of Milton Friedman (1955, 1962) in which he gave a potential response to the capital market's problem of financing (higher) education. Research on demand-sided financing include, e.g., Ziderman and Albrecht (1991, 1992, 1995), Chapman (1997, 2005), Barr (2001, 2004, 2005), Palacios (2004), Johnstone (2004, 2005), Barr and Crawford (2005), and Chapman and Ryan (2005). However, all of these articles focus on the financing of *higher education*, not primary education.

We know of only a few articles that examine the financing of primary education in developing countries, and they all focus on *public funding* (see Mookherjee and Ray (2008), and the references therein). To the best of our knowledge, private funding has not yet been addressed in the literature.

The idea of interlinking markets to circumvent the problem of limited collateral, limited incentives, or strategic default is not novel (see, e.g., Braverman and Stiglitz, 1982; Bell and Srinivasan, 1989). However, previous literature has only focused on interlinked agreements under the (implicit) assumption of immobile village societies, where information flow regarding past misdemeanors is assumed to be perfect, and therefore the agent's possibility of "default and run" ruled out. But, as Ghosh and Ray (2001) claim, mobility and anonymity are rising in developing societies and may initially lead to a decrease in information flow as the development of the country proceeds.

The articles closest in spirit to this paper are Genicot and Ray (2006), Stark and Falk (1998) as well as Flammer (2009). The former analyzes the effects of an improvement in contract enforcement on the terms of the credit contract and equilibrium payoffs depending on the agents' bargaining power. Stark and Falk (1998) develop a model in which the recipient's empathy is induced by gratitude for the donation (while the donor feels no empathy at all) in order to illustrate the interlacement of motives of altruism and

exchange. Finally, Flammer (2009) introduces an interlinkage between the market for higher education financing and the successive credit market.

THE MODEL

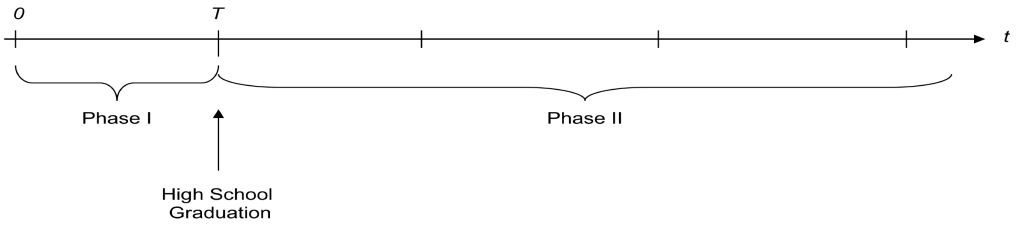
In the following, a model is introduced which endogenizes the mutual empathy of the agents (within a family), and the agents' decisions are formalized as the outcome of optimization problems. Then, we study the effect of a worsening of contract enforcement on the optimal contract design depending on the strength of family ties.

Basic Setup

We consider a repeated relationship between a risk-neutral principal and a risk-averse agent in a credit market with enforcement constraints. We further assume that the principal disposes of the absolute bargaining power and only grants credits to a borrower with proper (or no) credit history. In the following discussion, having a "proper credit history" means either of the following: 1) the agent has never been granted a credit, 2) he has complied with past contracts, or 3) a past default is not known to the principal. In other words, the principal disposes of no negative information regarding the agent's compliance with any potential past contracts. The availability of such credit history is restricted and crucially depends on the information technology as well as the mobility of agents. As past failures to comply with the agreement are only partially observed by other lenders, a defaulter may escape punishment and contract with other, uninformed lenders in future periods. For simplicity, suppose that contracts do not chronologically overlap. (This setting is most closely related to that described in Genicot and Ray (2006) who assume that every agent is a potential defaulter in an economy with imperfect information flow.)

The time frame is presented in Figure 1. The first phase represents the time until the child's maturity, which coincides with the graduation from high school. The second phase marks the time the child is on the job market and earns income. For simplicity and without loss of generality, we make the following assumptions: first, the child does not add to the household's income in the first phase; it either goes to school or stays home without earning any income. Second, we assume that the first phase only lasts one period while the second phase lasts indefinitely.

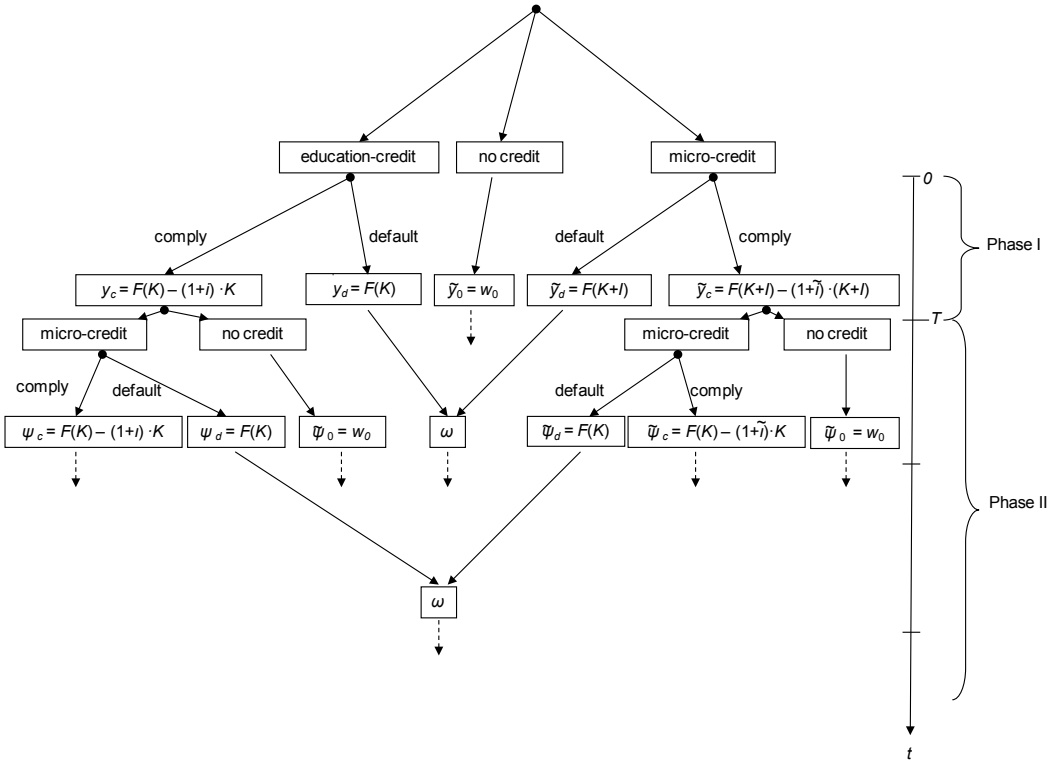
Figure 2: Timeline



This figure shows the time frame. The first phase represents the time until the child's maturity, which coincides with the graduation from high school. The second phase marks the time the child is on the job market and earns income.

Throughout the two phases, the potential borrower has different decisions to make. These decisions (partially) depend on the borrower's periodical pre-transfer incomes from the different choices. These are illustrated in Figure 2 and discussed in the following. Note that the dotted arrows in Figure 2 indicate that the agent obtains the same periodical pre-transfer income in future periods.

Figure 2: Periodical Pre-Transfer Income of the Borrower



This figure shows the decision tree of the borrower and the corresponding periodical pre-transfer incomes. As illustrated, in the first phase, the principal potentially offers two kinds of contracts: an education contract and a credit contract. If the borrower complies with the terms of contract, the lender offers him further credits in subsequent periods. However, if the borrower defaults, then he needs to find a different lender – who is uninformed about his past delinquency – in order to obtain further credit. Consequently, he obtains a continuation income ω.

In the first phase, the principal potentially offers two kinds of contracts: an education contract and a "credit contract". (Note that both contracts are, strictly speaking, credit contracts. However, in order to distinguish them from one another, we call one education contract and the other credit contract.) The former comprises the following: on one hand, the lender grants the borrower a credit *C* of amount *K* at some interest rate *i*. The borrower uses this credit for the production of some good.

Let us assume that the borrower needs a fixed amount of money in order to produce that good. Therefore, *K* is held constant while the interest rate *i* is a decision variable. Let us denote the production function as *F(C)*, where $F_C>0$ and $F_{CC} < 0$. On the other hand, the lender also "invests" the amount *I* into the education of the borrower's child. For simplicity, we assume that the investor cooperates with the school directly, i.e. he does not give the education money to the borrower. This feature prevents the risk that the borrower peculates the education money and uses it for his own purposes instead.

In addition, it is reasonable to assume that this feature also improves the enforcement of the education contract since the lender can credibly uphold the threat that the student only obtains his high school diploma if the borrower complies with the contract, i.e. if the latter repays the amount $(1 + i) \cdot K$. It is important to note that even though the amount of investment in education is not paid back, it is not a donation since the cost is borne by the parent.

If the borrower complies, his periodical pre-transfer income in the first phase is

$$y_c = F(K) - (1 + i) \cdot K. \qquad (1)$$

Compliance with the education contract leads to two outcomes: first of all, the student obtains his high school diploma which increases his market value on the job market and therefore his wage. Formally, we consider the following wage structure for the student:

$$w = \begin{cases} \underline{w} \text{ if child } \textit{without} \text{ diploma} \\ \overline{w} \text{ if child } \textit{with} \text{ diploma} \end{cases}, \tag{2}$$

where $\underline{w} < \overline{w}$. Second, the relationship between the lender and borrower is continued in the second phase. Henceforth, the borrower is eligible for microcredits of the amount K at some interest rate ι. Consequently, if the borrower also complies in the second phase, his periodical pre-transfer income in the second phase is (in each period – remember that the second phase entails an infinite number of periods)

$$\psi_c = F(K) - (1 + \iota) \cdot K. \tag{3}$$

Otherwise, that is if the borrower complies with the education contract but reneges on his credit arrangement in the second phase, the agent enjoys the entire production outcome in the second period, i.e.

$$\psi_d = F(K). \tag{4}$$

However, from the third period onwards, he only obtains some continuation income ω. This continuation income depends on the (legal) enforceability of contracts, punishments and sanctions as well as the availability of the borrower's credit history, where ω is certainly highest in societies in which mobility and anonymity are high and consequently the chance of detection lower. Furthermore, the continuation income also depends on the potential alternative periodical pre-transfer income $\tilde{\psi}_c$ which is derived below, see (8), where the former logically cannot exceed the value of the latter, i.e. $\omega \leq \tilde{\psi}_c$. The continuation income is the income a defaulting borrower can expect when trying to close a microcredit contract (in amount of K at interest rate $\tilde{\iota}$) with an uninformed lender.

If the borrower defaults on the education contract, then the consequences are as follows: on one hand, the relationship is ended and the agent enjoys the production outcome in the first period, i.e.

$$y_d = F(K), \tag{5}$$

but from the second period onwards, he only obtains the continuation income ω. On the other hand, misdemeanor leads the school to prevent the student's graduation. As a result, the student's market value is the same as without education, i.e. $w = \underline{w}$.

The second type of contract the lender potentially offers in the first phase is a credit contract in amount of $\tilde{C}$, where

$$\tilde{C} = K + I, \tag{6}$$

at an interest rate $\tilde{\iota}$. The assumption that the credit amount the lender grants to the borrower is equivalent to the amount he would lend in case of closing an education contract is made for tractability and without loss of generality. Again, the interest rate $\tilde{\iota}$ is a decision variable while the amount of credit $\tilde{C}$ is constant. With the credit contract, and in contrast to the education contract, the entire amount $\tilde{C}$ must be

compounded and repaid. In addition, the child remains uneducated and therefore gets wage $\underline{w}$ throughout its life.

If the borrower complies with this contract, then his periodical pre-transfer income in the first phase is

$$\tilde{y}_c = F(K+I) - (1+\tilde{\imath}) \cdot (K+I). \tag{7}$$

The relationship continues but the terms of contract change in the subsequent phase. Specifically, in the second phase, a credit contract in amount of K at interest rate $\tilde{\imath}$ is designed which yields a periodical pre-transfer income of

$$\tilde{\psi}_c = F(K) - (1+\tilde{\imath}) \cdot K \tag{8}$$

in case of compliance. This same contract is renewed again and again as long as the borrower repays.
In case that the borrower complies with the credit contract in the first phase but defaults on the microcredit contract in the second period, the borrower enjoys

$$\tilde{\psi}_d = F(K) \tag{9}$$

in the second period. In the subsequent periods, however, he only gets the continuation income ω.
If, in contrast, the borrower already defaults on the credit contract in the first period, then his periodical pre-transfer income in the first phase is

$$\tilde{y}_d = F(K+I). \tag{10}$$

And, from the second period onwards, he only enjoys the continuation income ω.
So far, not closing a contract (of any kind) has not been addressed. In the following, we assume that the non-borrower's pre-transfer income in the first phase is

$$\tilde{y}_0 = w_0, \tag{11}$$

where w_0 is the total wage the non-borrower earns if he does not increase his production by entering into a credit relationship. Now, if the parent does not take up a credit in the second phase – regardless of whether he has done so in the first phase – then he is in the same financial situation as in the first phase. Therefore, the non-borrower's pre-transfer income in the second phase is

$$\tilde{\psi}_0 = w_0. \tag{12}$$

So far, we have looked at the parent's pre-transfer income. This, however, is unlikely to be the parent's only income in developing countries, where a social welfare provision is missing. The absence of a social welfare provision has the following important consequences:

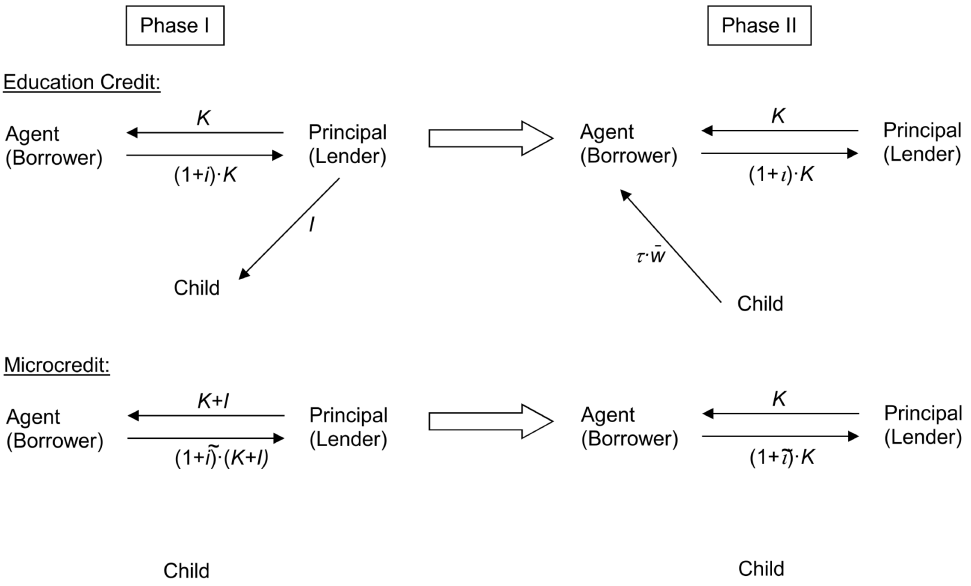
First of all, poor (especially senior) citizens are heavily reliant on monetary transfers from their children. These transfers – which are denoted by $\tau \cdot \overline{w}$ in Figure 3 below – are likely to be higher when the child is

educated and earns a higher income. Thus, the investment into a child's education can be viewed as an investment into the child's as well as one's own future.

Second, family ties are strengthened. That is, the child's empathy towards his parent is induced by his gratefulness for becoming educated and escaping extreme poverty. He cares for the parent's well-being and therefore financially supports his parent. Note, an uneducated child has no reason for being grateful and therefore will not financially support his parent (compare Figure 3 where no transfer is made in case of a pure credit contract). The empathy of the parent towards his child, in turn, is induced by the child's anticipated gratitude for his upbringing. It follows that the more grateful a child is, the more the child (financially) cares for his parent. The parent therefore cares more for his child's well-being. As a consequence, he is more willing to take out a loan and endure hardship in order to finance the child's education. This, in turn, increases the child's appreciation, and so forth.

The above described relationship and monetary transactions between the lender, borrower (parent) and the child are pictured in Figure 3 (for the case of compliance) and further discussed in the subsequent sections.

Figure 3: Monetary Transactions



This figure shows the relationship and monetary transactions between the lender, borrower and the child in phases I and II for both the education credit and the microcredit.

In the following, we first formalize the child's empathy towards his parent which arises from its gratitude for becoming educated and escaping poverty. Then, we derive the optimal transfer he makes to his parent. Finally, we formalize the parent's empathy towards his child and determine the optimal contract design of the education credit as well as the microcredit.

Child's Empathy and Decision

The parent's act of sending the child to school does not (officially) bind the child in any way, but it instills gratitude and consequently induces empathy. As a result, the child feels obliged to help his parent if the latter suffers financial distress. Let us consider the following empathy function which depends on the child's as well as the parent's pre-transfer income:

$$\beta = \begin{cases} 0 & if\ w - \psi\ \leq 0 \\ b(w,\psi) & if\ w - \psi > 0\ , \end{cases} \tag{13}$$

where $\psi \in \{\psi_c, \psi_d,\ \tilde{\psi}_c, \tilde{\psi}_d, \tilde{\psi}_0, \omega\}$, $\underline{w} \leq \psi$, $0 \leq b(w,\psi) \leq 1$, and $\frac{\partial b}{\partial w} \geq 0$, $\frac{\partial b}{\partial \psi} \leq 0$. Note that ψ is the set of the different potential periodical pre-transfer incomes of the borrower in the second phase.

In the following, we elaborate on the intuition behind the conditions listed above. We start with the condition $\underline{w} \leq \psi$. Arguably, it is reasonable to assume that an uneducated child can at most earn as much as his parent earns in the second phase. The economic intuition behind this assumption is that a parent – who might be uneducated himself – has the option to take up a credit and improve his periodic income whereas this option is not given to the child. Thus, provided that an uneducated child would earn as much as an uneducated and non-contracting parent, the income of the uneducated child is always (weakly) lower than that of the parent in the second phase. The next condition, i.e. $0 \leq b(w,\psi) \leq 1$, imposes that the child's empathy is bounded between zero and one. Thus, the child could basically care more for his parent's well-being than for his own. According to the last two conditions ($\frac{\partial b}{\partial w} \geq 0$ and $\frac{\partial b}{\partial \psi} \leq 0$), the child's empathy is increasing in his own wage and decreasing in the parent's periodical pre-transfer income (in the second phase). To put it differently, the child's empathy is a function of the difference in pre-transfer incomes.

The formalization in (13) assumes that the child is not backward-looking. This means that the child only takes the current financial distress of the parent into account but not past situations of financial distress. Furthermore, it states that empathy only arises if the child is financially better off than the parent. The economic intuition for this is as follows: a person with a low income is likely to have difficulties to make ends meet. It follows that this person has enough trouble to take care of his own family (offsprings) and has therefore to be "selfish" enough. In other words, he has no free resources to spare, especially not for someone who is financially better off.

Furthermore, we impose that a child only feels sympathy for someone who keeps his agreements and does not default. In other words, only if the parent is a "good citizen" and causes no (financial) harm to other persons does the child's empathy arise. This assumption is made for simplicity and without loss of generality. However, it is plausible to assume that education not only imparts knowledge but likely also morals.

In the subsequent discussion, we assume that the child is risk-averse and his one-period utility function is quadratic and of the following form:

$$u_t^B = (1-\beta) \cdot [c \cdot (1-\tau) \cdot w - \frac{d}{2} \cdot ((1-\tau) \cdot w)^2] + \beta \cdot [c \cdot (\psi + \tau \cdot w) - \frac{d}{2} \cdot (\psi + \tau \cdot w)^2], \tag{14}$$

where the superscript B stands for the child, and the rate of monetary transfer (as percentage of his income) is denoted by τ, $\tau \in [0,1]$. The rate of transfer is the child's sole decision variable. The ratio $\frac{c}{d}$ is an indicator for the child's risk-aversion, where c and d are parameters. That is, the lower is the ratio, the more risk-averse the child is. If the child is risk-neutral, then $d = 0$. Note that, by construction, the child's post-transfer income has to be smaller than $\frac{c}{d}$, i.e.

$$(1-\tau) \cdot w \leq \frac{c}{d}. \tag{15}$$

(This is a well-known property of the quadratic utility function. If $u(x) = c \cdot x - \frac{d}{2} \cdot x^2$, then $u'(x) \geq 0$ requires $x \leq \frac{c}{d}$.) Finally, in order to impose $\tau \in [0, 1]$, we set $\frac{c}{d} = \overline{w}$.

The economic intuition behind relation (14) (in combination with (13)) is that the child's utility not only depends on his own but also on his parent's well-being. The extent of the child's caring for his parent – his empathy – arises from his gratitude for enjoying a higher income thanks to his education. Note that, so far, no decision-making is involved. The only optimization the child actually undertakes is when he decides upon the rate of monetary transfer. To determine the optimal rate of transfer, the child maximizes his utility, taking the parent's pre-transfer income ψ as given:

$$\max_{\tau}(1-\beta) \cdot \left[c \cdot (1-\tau) \cdot w - \frac{d}{2} \cdot ((1-\tau) \cdot w)^2\right] + \beta \cdot \left[c \cdot (\psi + \tau \cdot w) - \frac{d}{2} \cdot (\psi + \tau \cdot w)^2\right] \qquad (16)$$

subject to the child's budget constraint

$$(1-\tau) \cdot w \geq s, \qquad (17)$$

where s denotes the minimum cost of living. For simplicity and without loss of generality, we set $s \equiv 0$. Since we have that $\tau \in [0, 1]$ and w is positive, we know that the budget constraint (17) is always fulfilled. Thus, we have an unconstrained optimization problem.

Proposition 1. *The optimal rate of monetary transfer is* $\tau^* = max\left\{0,\ \beta \cdot \left(1 - \frac{\psi}{w}\right)\right\}$.

Proof. Appendix A establishes the Proof of Proposition 1.

Proposition 1 unsurprisingly reveals that the optimal rate of monetary transfer is zero when the child has no empathy towards his parent, i.e. $\beta = 0$, which is the case if the child's pre-transfer income is not higher than that of his parent (see (13)). More importantly, it also states that a positive optimal rate of transfer is increasing in empathy, i.e. $\frac{\partial \tau^*}{\partial \beta} > 0$. Hence, a grateful child can increase its own welfare by financially helping his parent in need. Finally, note that the child's empathy and therefore also his optimal transfer, $\tau^* \cdot w$, are an outcome of the child's gratitude without assuming that altruistic behavior is exogenously given. The academic literature, in contrast, often imposes a fixed level of empathy without explaining i) why the empathy arises in the first place, and ii) how the level of empathy is determined (see, e.g., Becker (1991) as well as Kolm and Mercier Ythier (2006a, 2006b)).

In the following, we derive the parent's empathy towards his child.

Parent's Empathy and Decision

The parent's empathy towards his offspring arises due to the anticipated gratitude of his child. Thus, the parent's empathy is also endogenously determined. It is natural to assume that empathy is positively correlated with the percentage of income the child transfers to his parent. Therefore, we write:

$$\alpha = a(\tau), \qquad (18)$$

where α denotes the parent's empathy and $\frac{\partial a}{\partial \tau} \geq 0$. For simplicity and without loss of generality, we assume that the parent's empathy towards his child does not depend on any intrinsic parental feelings but is induced only by the expected rate of monetary transfer, i.e. $a(\tau = 0) \equiv 0$.

Suppose that the borrower has the same risk-aversion as his child, and anticipates his child's decision. Furthermore, his one-period utility function is quadratic and, in the second phase, can be written as follows:

$$u_2^A(\psi, \tau^*) \tag{19}$$
$$= (1-\alpha) \cdot \left[c \cdot (\psi + \tau^* \cdot w) - \frac{d}{2} \cdot (\psi + \tau^* \cdot w)^2\right] + \alpha$$
$$\cdot \left[c \cdot (1-\tau^*) \cdot w - \frac{d}{2} \cdot [(1-\tau^*) \cdot w]^2\right],$$

where the superscript A stands for the borrower (parent), the subscript 2 indicates the second phase, and $\psi \in \{\psi_c, \psi_d, \tilde{\psi}_0, \tilde{\psi}_c, \tilde{\psi}_d, \omega\}$.

From the discussion above, it follows that if the optimal rate of transfer is zero, i.e. $\tau^* = 0$, then the periodic utility function (19) reduces to

$$u_2^A(\psi, 0) = c \cdot \psi - \frac{d}{2} \cdot \psi^2. \tag{20}$$

That is, if the child does not transfer any money, then the parent has no empathy for the child and is only concerned about his own welfare.

In the first phase, in contrast to the second phase, the child earns no income and lives with his parent in the same household. Consequently, the empathy towards the child plays no role in the first period, and we can write the parent's one-period utility function as

$$u_1^A(y) = c \cdot y - \frac{d}{2} \cdot y^2, \tag{21}$$

where y, $y \in \{y_c, y_d, \tilde{y}_0, \tilde{y}_c, \tilde{y}_d\}$, belongs to the set of the various potential periodical incomes of the parent in the first period (see (1), (5), (7), (10), (11), as well as Figure 2).

The parent's lifetime utility is additive time-separable. For simplicity, we assume that the discount factor δ is constant over time and common for all parties.

In the first period, the parent is credit constrained but has the option to take up either an education credit or a microcredit. Regardless of the type of credit, this paper studies the case when the lender disposes of the absolute bargaining power. That is, the lender decides upon the interest rate for a given amount of capital. It follows that the parent only decides whether to contract at all, and if so, which credit he ought to choose. Furthermore, he also decides upon keeping or breaking the agreement. All these decisions depend entirely on the present value of his lifetime utilities from the various options. It follows that the contract design of the different credit types plays a vital role in the decision-making of the borrower. Accordingly, we now turn to the principal's decision-making.

Lender's Decision

The principal is assumed to be risk-neutral and to have all bargaining power – he designs the contract such that his lifetime utility, denoted by U^P, is maximized while satisfying the following constraints: First, keeping in mind that we intend to find a way to finance primary education, the investor must find it best to offer an education contract in the first phase. The lender has an incentive to offer an education contract only if it gives him a higher lifetime utility than closing a credit contract or not contracting at all in the first phase (see (23)). Second, the participation of the opportunistic agent – the parent – must be guaranteed, i.e. complying with the education contract must bring about a higher lifetime utility than opting for a credit contract in the first period (see (24)). Third, contracting again in the second phase must give the agent a higher utility than not contracting (see (25)).

Finally, the last and – due to the absence of legal enforceability – crucial constraints are that the design of the education contract as well as the microcredit contract must be self-enforcing at every point in time in order to give the agent incentives to comply in each period (see (26) and (27)). Precisely, in every period, the borrower must be better off by complying and obtaining credit from the same lender in the future periods than by defaulting and enjoying the continuation value in the subsequent periods.

Formally, the lender's constrained optimization problem can be written as follows (remember that the first phase lasts one period while the second phase lasts an infinite number of periods):

$$\max_{i,\,\iota} U^P(i,\iota) = i \cdot K + \frac{\delta}{1-\delta} \cdot \iota \cdot K \tag{22}$$

subject to the principal's incentive constraint to grant an education credit in the first phase followed by a microcredit in the second phase

$$U^P(i,\iota) \geq U^P(\tilde{\imath},\tilde{\iota}), \tag{23}$$

the agent's participation constraint in the first phase

$$u_1^A\big(y_c(i)\big) + \frac{\delta}{1-\delta} \cdot u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) \geq \; u_1^A\big(\tilde{y}_c(\tilde{\imath})\big) + \frac{\delta}{1-\delta} \cdot u_2^A\big(\tilde{\psi}_c(\tilde{\iota}), 0\big), \tag{24}$$

the agent's participation constraint in the second phase

$$u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) \geq u_2^A\left(\tilde{\psi}_0, \tau^*\big(\tilde{\psi}_0, \overline{w}\big)\right), \tag{25}$$

the self-enforcement constraint in the first phase

$$u_1^A\big(y_c(i)\big) + \frac{\delta}{1-\delta} \cdot u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) \geq u_1^A(y_d) + \frac{\delta}{1-\delta} \cdot u_2^A(\omega, 0), \tag{26}$$

and the self-enforcement constraint in the second phase

$$u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) \; \geq (1-\delta) \cdot u_2^A(\psi_d, 0) + \delta \cdot u_2^A(\omega, 0), \tag{27}$$

where $y_d = \psi_d$. For simplicity and without loss of generality, we set $\tilde{\iota} \equiv 0$ as well as $U^P(\tilde{\imath}, \tilde{\iota}) = 0$.

Consequently, the Lagrangian function is:

$$\mathcal{L}(i, \iota, \lambda_1, \lambda_2, \lambda_3, \lambda_4) = f(i, \iota) + \sum_{j=1}^{2} \lambda_j \cdot g_j(i, \iota) + \lambda_3 \cdot g_3(\iota) + \lambda_4 \cdot g_4(i, \iota) + \lambda_5 \cdot g_5(\iota), \tag{28}$$

where $f(i, \iota)$ is the objective function, λ_j, $j = 1,..,5$, are Lagrange multipliers, and $g_1(i, \iota)$ through $g_5(\iota)$ denote the functions corresponding to the various constraints of the lender's optimization problem, i.e.

$$g_1(i, \iota) = U^P(i, \iota) - U^P(\tilde{\imath}, \tilde{\iota}), \tag{29}$$

$$g_2(i, \iota) = u_1^A\big(y_c(i)\big) - u_1^A\big(\tilde{y}_c(\tilde{\imath})\big) + \frac{\delta}{1-\delta} \cdot \big[u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) - u_2^A\big(\tilde{\psi}_c(\tilde{\imath}), 0\big)\big], \tag{30}$$

$$g_3(\iota) = u_2^A\big(\psi_c(\iota),\, \tau^*(\psi_c, \overline{w})\big) - u_2^A\left(\tilde{\psi}_0, \tau^*\big(\tilde{\psi}_0, \overline{w}\big)\right), \tag{31}$$

$$g_4(i, \iota) = u_1^A\big(y_c(i)\big) - u_1^A(y_d) + \frac{\delta}{1-\delta} \cdot \big[u_2^A\big(\psi_c(\iota), \tau^*(\psi_c, \overline{w})\big) - u_2^A(\omega, 0)\big], \tag{32}$$

$$g_5(\iota) = u_2^A\big(\psi_c(\iota),\, \tau^*(\psi_c, \overline{w})\big) - (1-\delta) \cdot u_2^A(\psi_d, 0) - \delta \cdot u_2^A(\omega, 0). \tag{33}$$

In general, we do not know which constraints will be binding at the maximum (a full characterization of the solution would require an additional set of assumptions). However, the problem is only interesting when the enforcement constraints bind. Otherwise, the principal simply sets i and ι such that the participation contraint binds in each period, and the credit agreement simplifies to the solution of a standard contracting model without limitation on contract enforcement. In the following, we only consider the more interesting case with binding enforcement constraints. That the enforcement constraints bind at the optimum is very intuitive. A contract design which ensures the participation of the contracting partners – and therefore the closing of the contract – does not necessarily lead to the compliance of the borrower. Thus, a lender will likely give priority to the self-enforcement of the agreement and check only afterwards whether participation of the borrower is guaranteed. For a similar argument, see, e.g., Genicot and Ray (2006), Banerjee and Ghatak (2004), Ghosh, Mookherjee and Ray (2000).

In the following, we determine the optimal contract design, i.e. the optimal interest rates in phases one and two, from the two self-enforcement constraints and then solve the constrained optimization problem by backward induction.

In a first step, we consider the self-enforcement constraint in the second phase (27) which is binding. Rewriting it and using (19) as well as (20), we obtain the optimal interest rate in phase two:

$$\iota^* = g^{-1}(0), \tag{34}$$

where

$$g(\iota) \tag{35}$$
$$= \left(1 - a\left(\tau^*(\psi_c(\iota), \overline{w})\right)\right) \cdot \left[c \cdot (\psi_c(\iota) + \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w}) - \frac{d}{2} \cdot (\psi_c(\iota) + \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w})^2\right]$$
$$+ a\left(\tau^*(\psi_c(\iota), \overline{w})\right) \cdot \left[c \cdot \left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w} - \frac{d}{2} \cdot \left[\left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w}\right]^2\right] - (1 - \delta)$$
$$\cdot \left[c \cdot \psi_d - \frac{d}{2} \cdot {\psi_d}^2\right] - \delta \cdot \left[c \cdot \omega - \frac{d}{2} \cdot \omega^2\right].$$

In a second step, we consider the self-enforcement constraint in the first phase (26), which is also binding. The optimal interest rate in phase one is obtained by using equation (19), (20), and (21), taking the optimal interest rate from phase two (34) as given. We obtain

$$i^* = h^{-1}(0), \tag{36}$$

where

$$h(i) \tag{37}$$
$$= \; c \cdot \left(y_c(i) - y_d - \frac{\delta}{1 - \delta} \cdot \omega\right) - \frac{d}{2} \cdot \left(y_c(i)^2 - {y_d}^2 - \frac{\delta}{1 - \delta} \cdot \omega^2\right) + \frac{\delta}{1 - \delta}$$
$$\cdot \left(\begin{array}{l} \left(1 - a\left(\tau^*(\psi_c(\iota^*), \overline{w})\right)\right) \cdot \left[c \cdot (\psi_c(\iota^*) + \tau^*(\psi_c(\iota^*), \overline{w}) \cdot \overline{w}) - \frac{d}{2} \cdot (\psi_c(\iota^*) + \tau^*(\psi_c(\iota^*), \overline{w}) \cdot \overline{w}) \right. \\ \qquad \left. + a\left(\tau^*(\psi_c(\iota^*), \overline{w})\right) \cdot \left[c \cdot \left(1 - \tau^*(\psi_c(\iota^*), \overline{w})\right) \cdot \overline{w} - \frac{d}{2} \cdot \left[\left(1 - \tau^*(\psi_c(\iota^*), \overline{w})\right) \cdot \overline{w}\right]^2\right] \end{array} \right)$$

As we argued above, mobility and anonymity are rising in developing societies and presumably lead to a decrease in information flow at some stage of the economic development. Most certainly, this decrease in information flow will affect the enforcement of contracts. Therefore, we now turn to the consequences of a change in information flow on the optimal contract design. Precisely, we study the effect of an impairment in contract enforcement (which is induced by a deterioration in information flow) on the optimal interest rate in phases one and two ((36) and (34), respectively).

Comparative Statics: Change In Contract Enforcement

The worsening of enforcement can be seen as an increase in the agent's continuation income ω, where ω is highest if the agent is able to contract in each period with an uninformed lender and default without getting punished. However, we know that if defaulting leads neither to punishment nor any limitations in obtaining new credit, then the agent would naturally always default (regardless of the contract design). Let us denote this maximal level as $\overline{\omega}$, where

$$\overline{\omega} = F(K). \tag{38}$$

We know that if $\omega = \overline{\omega}$, then the self-enforcement constraint cannot be met. Consequently, any continuation income that satisfies the self-enforcement constraint must always be strictly smaller than the natural upper bound, i.e. $\omega < F(K)$.

Proposition 2. *We have that* $\frac{di^*}{d\omega} \leq 0$, *where* $\frac{di^*}{d\omega}$ *is independent of* α *and* β, *and* $\frac{d\iota^*}{d\omega}(\alpha = \alpha_0) \leq 0$. *Furthermore, we have that*

$$\left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = \beta_0)\right| \leq \left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = 0)\right|,$$

and

$$\left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0)\right| \leq \left|\frac{d\iota^*}{d\omega}(\alpha = 0)\right|, \text{if } \beta \leq 0.5$$
$$\left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0)\right| > \left|\frac{d\iota^*}{d\omega}(\alpha = 0)\right|, \textit{otherwise}.$$

Proof. Appendix B establishes the Proof of Proposition 2 in detail.

Proposition 2 claims that a worsening in contract enforcement ultimately causes the interest rate on the *education credit* in phase one to always decrease. It is little surprising that this change is independent of the underlying assumptions regarding the child's and parent's empathy towards each other since both are assumed to live within the same household during the first phase. More interesting is the effect on the interest rate of the *microcredit* in the subsequent phase. This effect is ambiguous. Precisely, we find that a deterioration in contract enforcement always leads to a lower interest rate on the microcredit under the assumption that the parent's empathy towards his child is constant, i.e. $\alpha = \alpha_0$ with $\alpha_0 \in [0,1]$. The extent to which the parent cares for his child's well-being does not depend on the anticipated rate of transfer.

The economic intuition behind the above finding is straightforward: a rise in the continuation value (e.g., due to a worsening of information flow) causes a violation of the self-enforcement constraint. Reneging on a current agreement becomes more attractive for the parent than complying. As a consequence, the contract design must be adjusted in order to restore self-enforcement. More precisely, the post-transfer income of the parent must be raised. This is accomplished by lowering the interest rate for the following reason: a decrease in the interest rate leads to an increase in the parent's pre-transfer income. A marginal increase in the parent's pre-transfer income, in turn, results in a relatively low increase of transfer, i.e.

$\left|\frac{\partial \tau^*}{\partial \psi_c}\right| \cdot \overline{w} \leq 1$. This means that, despite a lower monetary transfer from the child, the parent's post-transfer increases after an increase in pre-transfer income. Thus, a rise of mobility and anonymity in developing societies leads to a decrease in the optimal interest rate on the microcredit ι in order to prevent the borrower from reneging on the contract.

This result is in line with the finding of Genicot and Ray (2006) who argue that, under the assumption of pure selfish behavior, an improvement in enforcement leads to a decrease of the borrower's utility if the lender has enough bargaining power. By extending their framework and allowing for endogenous altruistic behavior, we find that a worsening of contract enforcement causes the interest rate ι on the

microcredit (in the second phase) to decrease less when the child and parent feel some empathy towards each other than when the child only cares about his own well-being, i.e. $\left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = \beta_0)\right| \leq \left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = 0)\right|$, with $\alpha_0 \in [0,1]$ and $\beta_0 \in [0,1]$. Furthermore, we also find that a decrease in information flow causes the interest rate ι to decrease less when the parent feels some empathy towards his child than when the parent is motivated purely on the basis of exchange motives. However, this is only true as long as the child cares more for himself than for his parent. If, in contrast, the child attaches greater importance to the well-being of his parent than his own, then a worsening of contract enforcement has the opposite effect.

This finding has important policy implications since it means that in societies where family ties are stronger and people more grateful, the rise of mobility and anonymity causes the interest rate to fall less than in more individualistic societies. Hence, the caring (empathy) of family members for each other is not only a way to insure themselves against financial distress but also dampens the negative effect of a deterioration in contract enforcement on the lender's payoff. If, however, gratefulness exceeds a rational level – that is when the child's gratefulness takes the form of self-sacrificing itself for the parent's well-being – then an increase in mobility and anonymity demands a sharper decrease in the interest rate in altruistic compared to more individualistic societies.

CONCLUSION

The objective of this paper has been to present a financing scheme which promises to enhance access to primary education in developing countries, without relying on the legal enforceability of contracts, traditional collateral or contracting with minors. Furthermore, due to increased mobility and anonymity in developing countries, we have analyzed its effect on the optimal terms of the contracts depending on the strength of family ties and have found that family ties matter; they not only prevent the family members from financial hardship (e.g., during retirement) but can also mitigate the fall of the lender's payoff due to limited contract enforcement. The proposed financing scheme is only a first step in this mostly unexplored field. Further research is needed that, e.g., explores the importance of cultural characteristics on the design of self-enforcing contracts.

APPENDICES

Appendix A

In the following, we establish the proof to Proposition 1 which claims that the optimal amount of transfer is given by $\tau^* = max\left\{0,\ \beta \cdot \left(1 - \frac{\psi}{w}\right)\right\}$.
The child's optimization problem is as follows:

$$\max_{\tau}(1-\beta)\cdot\left[c\cdot(1-\tau)\cdot w - \frac{d}{2}\cdot((1-\tau)\cdot w)^2\right] + \beta\cdot\left[c\cdot(\psi+\tau\cdot w) - \frac{d}{2}\cdot(\psi+\tau\cdot w)^2\right] \qquad (1A)$$

subject to the child's budget constraint

$$(1-\tau)\cdot w \geq 0, \qquad (2A)$$

where $\psi \in \{\psi_c, \psi_d,\ \tilde{\psi}_c, \tilde{\psi}_d, \omega\},\ w \in \{\underline{w}, \overline{w}\},\ \underline{w} \leq \psi,\ \overline{w} = \frac{c}{d}$ and $\beta = \begin{cases} 0 & \text{if } w-\psi \leq 0 \\ b(w,\psi) & \text{if } w-\psi > 0 \end{cases}$. As stated in the main text, the budget constraint is always fulfilled when $\tau \in [0,1]$. Thus, the solution of this constrained optimization problem is identical to the solution of the corresponding unconstrained optimization problem. The solution τ^* follows straight from the first order condition. Specifically, taking into account that the child views the parent's pre-transfer income ψ as exogenous when maximizing his utility, we obtain the optimal transfer

$$\tau^* = \begin{Bmatrix} \beta\cdot\left(1-\frac{\psi}{w}\right) & \text{if } w=\overline{w} \wedge \psi=\psi_c \\ 0 & \text{otherwise} \end{Bmatrix}, \qquad (3A)$$

which completes the proof.

Appendix B

In this appendix, we provide the Proof of Proposition 2 which states that a worsening in contract enforcement ultimately causes the interest rate on the education credit (phase 1) to decrease while the effect on the interest rate of the microcredit (phase 2) is ambiguous. The latter decreases if the parent's empathy is constant. In addition, Proposition 2 claims that a deterioration in contract enforcement causes the interest rate on the microcredit to decrease less when the child and parent feel some empathy towards each other than when they are either selfish and ungrateful, or when the child sacrifices itself for the well-being of his family.

The optimal interest rate in phase one is given by

$$i^* = h^{-1}(0), \tag{1B}$$

where $h(i)$ is defined in (37), and we have

$$\frac{di^*}{d\omega} = -\frac{h_\omega}{h_i}, \tag{2B}$$

where h_ω denotes the partial derivative of $h(i)$ with respect to the continuation income ω and h_i denotes the partial derivative of $h(i)$ with respect to the interest rate i. The latter is given by

$$h_i = \frac{\partial y_c}{\partial i} \cdot \Big(c - d \cdot \big(y_c(i)\big)\Big), \tag{3B}$$

where $\frac{\partial y_c}{\partial i} < 0$. Since we know that, by construction, income must be smaller than the ratio $\frac{c}{d}$, we can exclude the case that $y_c(i) \geq \frac{c}{d}$. It follows that

$$h_i < 0. \tag{4B}$$

The partial derivative of $h(i)$ with respect to ω, on the other hand, is

$$h_\omega = -\frac{\delta}{1-\delta} \cdot (c - \mathrm{d} \cdot \omega). \tag{5B}$$

Thus, for the same reason (regarding income) as above, we have that

$$h_\omega < 0. \tag{6B}$$

From (4B) and (6B), it follows that

$$\frac{di^*}{d\omega} < 0. \tag{7B}$$

We can conclude that an improvement in contract enforcement (which diminishes ω) always causes the interest rate on the education credit to rise.

Let us now turn to the optimal interest rate in the second phase, which is given by (34), i.e.

$$\iota^* = g^{-1}(0), \tag{8B}$$

where $g(\iota)$ is defined as in (35). We can write

$$\frac{d\iota^*}{d\omega} = -\frac{g_\omega}{g_\iota}, \tag{9B}$$

where g_ω stands for the partial derivative of $g(\iota)$ with respect to the continuation income ω and g_ι denotes the partial derivative of $g(\iota)$ with respect to the interest rate ι. The former is

$$g_\omega = -\delta \cdot [c - d \cdot \omega], \tag{10B}$$

where $\omega < \frac{c}{d}$ by construction. Therefore, the partial derivative of $g(\iota)$ with respect to the continuation value is always negative, i.e.

$$g_\omega < 0. \tag{11B}$$

It follows that the change in ι^* due to a deterioration of contract enforcement is of the same sign as the partial derivative of $g(\iota)$ with respect to the interest rate in the second phase:

$$sign\left[\frac{d\iota^*}{d\omega}\right] = sign[g_\iota]. \tag{12B}$$

The partial derivative of $g(\iota)$ with respect to the interest rate ι is given by

$$g_\iota = \left[\xi + \left(\eta + \vartheta \cdot \frac{\partial a}{\partial \tau}\right) \cdot \frac{\partial \tau^*}{\partial \psi_c}\right] \cdot \frac{\partial \psi_c}{\partial \iota}, \tag{13B}$$

where

$$\xi := \left(1 - a\left(\tau^*(\psi_c(\iota), \overline{w})\right)\right) \cdot [c - d \cdot (\psi_c(\iota) + \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w})], \tag{14B}$$

$$\eta := \overline{w} \cdot \left[c \cdot \left[1 - 2 \cdot a\left(\tau^*(\psi_c(\iota), \overline{w})\right)\right] - d \cdot \begin{pmatrix} \psi_c(\iota) \cdot \left[1 - a\left(\tau^*(\psi_c(\iota), \overline{w})\right)\right] \\ +\overline{w} \cdot \left(\tau^*(\psi_c(\iota), \overline{w}) - a\left(\tau^*(\psi_c(\iota), \overline{w})\right)\right) \end{pmatrix}\right], \tag{15B}$$

$$\vartheta := c \cdot [1 - 2 \cdot \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w} - \psi_c(\iota)] - \frac{d}{2} \cdot \begin{pmatrix} \left[\left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w}\right]^2 \\ -[(\psi_c(\iota) + \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w})]^2 \end{pmatrix}, \tag{16B}$$

and $\frac{\partial a}{\partial \tau} \geq 0$, $\frac{\partial \tau^*}{\partial \psi_c} \leq 0$, and $\frac{\partial \psi_c}{\partial \iota} < 0$.

(13B) is too involved to be interpreted. Therefore, we study the case where the borrower's empathy towards his child is independent of his transfer, i.e. $\alpha = \alpha_0$ with $\alpha_0 \in [0,1]$ and $\frac{\partial a}{\partial \tau} = 0$. Since $\frac{c}{d} = \overline{w}$, (13B) simplifies to

$$g_\iota = \left[\xi + \eta \cdot \frac{\partial \tau^*}{\partial \psi_c}\right] \cdot \frac{\partial \psi_c}{\partial \iota}, \tag{17B}$$

where

$$\xi := (1-\alpha_0) \cdot d \cdot \left[\left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w} - \psi_c(\iota)\right], \tag{18B}$$

$$\eta := \overline{w} \cdot d \cdot \left[\, (1-\alpha_0) \cdot \left(\overline{w} - \psi_c(\iota)\right) - \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w}\right]. \tag{19B}$$

It is reasonable to assume that $\left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w} \geq \psi_c(\iota) + \tau^*(\psi_c(\iota), \overline{w}) \cdot \overline{w}$, which means that the order of post-transfer incomes remains the same as prior to the transfer. Otherwise, the child would be worse off after transferring money than his parent is. It follows that $\xi \geq 0$. Furthermore, we have that

$$\eta \begin{cases} \geq 0 & \text{if } \left(1 - \tau^*(\psi_c(\iota), \overline{w})\right) \cdot \overline{w} - \psi_c(\iota) \geq \alpha_0 \cdot \left(\overline{w} - \psi_c(\iota)\right) \\ \leq 0 & \text{otherwise} \end{cases}. \tag{20B}$$

It follows that $g_\iota \leq 0$ and therefore

$$\frac{d\iota^*}{d\omega}(\alpha = \alpha_0) \leq 0. \tag{20B}$$

Now, let us compare the slopes of the contour line. We know that (10B) is independent of α and β. Thus, the denominators of all slopes are the same, and we only need to compare the nominators. It is straightforward to see that

$$g_\iota(\alpha = \alpha_0,\ \beta = \beta_0) \geq g_\iota(\alpha = \alpha_0,\ \beta = 0), \tag{21B}$$

and

$$\begin{aligned} &g_\iota(\alpha = \alpha_0) \geq g_\iota(\alpha = 0) \quad \text{if } \beta \leq 0.5 \\ &g_\iota(\alpha = \alpha_0) < g_\iota(\alpha = 0) \quad \text{otherwise'} \end{aligned} \tag{22B}$$

where $\alpha_0 \in [0,1]$ and $\beta_0 \in [0,1]$. It follows that

$$\left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = \beta_0)\right| \leq \left|\frac{d\iota^*}{d\omega}(\alpha = \alpha_0,\ \beta = 0)\right|, \tag{23B}$$

and

$$\begin{array}{ll} \left|\frac{d\iota^*}{d\omega}(\alpha=\alpha_0)\right| \leq \left|\frac{d\iota^*}{d\omega}(\alpha=0)\right|, & \text{if } \beta \leq 0.5 \\ \left|\frac{d\iota^*}{d\omega}(\alpha=\alpha_0)\right| > \left|\frac{d\iota^*}{d\omega}(\alpha=0)\right|, & \text{otherwise} \end{array}. \quad (24B)$$

This completes the proof.

REFERENCES

Armendáriz de Aghion, B. & Morduch, J. (2004), Microfinance: Where Do We Stand? In: Ch. Goodhart (ed.), *Financial Development and Economic Growth: Explaining the Links*, London: Macmillan/Palgrave, 135-148.

Armendáriz de Aghion, B. & Morduch, J. (2005), *The Economics of Microfinance*, 1st edn., Cambridge, MA: MIT Press.

Banerjee, A. & Ghatak, M. (2004), Eviction Threats and Investment Incentives. *Journal of Development Economics*, 74, 469-488.

Barr, N. (2001), *The Welfare State as Piggy Bank: Information, Risk, Uncertainty, and the Role of the State*, Oxford: Oxford University Press.

Barr, N. (2004), Higher Education Funding. *Oxford Review of Economic Policy*, 20 (2), 264-283.
Barr, N. (2005), Financing Higher Education. *Finance & Development*, 42 (2).

Barr, N. & Crawford, I. (2005), *Financing Higher Education: Answers from the UK*, London and New York: Routledge.

Becker, G. S. (1991), *A Treatise on the Family*, 2nd edn., Cambridge, MA: Harvard University Press.
Bell, C. & Srinivasan, T. N. (1989), Interlinked Transactions in Rural Markets: An Empirical Study of Andhra Pradesh, Bihar and Punjab. *Oxford Bulletin of Economics and Statistics*, 51 (1), 73-83.

Braverman, A. & Stiglitz, J. E. (1982), Sharecropping and the Interlinking of Agrarian Markets. *American Economic Review*, 72 (4), 695-715.

Chapman, B. (1997), Conceptual Issues and the Australian Experience with Income Contingent Charges for Higher Education. *Economic Journal*, 107, 738-751.

Chapman, B. (2005), *Income Contingent Loans for Higher Education: International Reform*, CEPR Discussion Paper 491, CEPR, Canberra.

Chapman, B. & Ryan, C. (2005), The Access Implications of Income Contingent Charges for Higher Education: Lessons from Australia. *Economics of Education Review*, 24, 491-512.

Dunford, C. (2001), *Building Better Lives – Sustainable Linkage of Microcredit and Education in Health, Family Planning and HIV/AIDS Prevention for the Poorest Entrepreneurs*, Discussion Paper for the Microcredit Summit Campaign.

Dunford, C. (2003), Adding Value to Microfinance and to Public Health Education – At the Same Time. *Asian Development Bank's Finance for the Poor Newsletter*, 4:4.

Dunford, C. & Denman, V. (2001), *Credit with Education: A Promising title II Microfinance Strategy, Food and Nutrition Technical Assistance Project*, Academy of Educational Development, Washington, DC.

Flammer, C. (2009), *The Financing of Education in Developing Countries: Models of Sustainable Educational Contracts,* Saarbruecken: Suedwestdeutscher Verlag fuer Hochschulschriften.

Friedman, M. (1955), The Role of Government in Education. In: R. A. Solo (ed.), *Economics and the Public Interest*. New Brunswick, N J.: Rutgers University Press.

Friedman, M. (1962), *Capitalism and Freedom*, Chicago: Chicago University Press.

Genicot, G. & Ray, D. (2006), Bargaining Power and Enforcement in Credit Markets. *Journal of Development Economics*, 79, 398-412.

Ghosh, P., Mookherjee, D. and Ray, D. (2000), Credit Rationing in Developing Countries: An Overview of the Theory. In: D. Mookherjee and D. Ray (eds.), *A Reader in Development Economics*, 283-301. London: Blackwell.

Ghosh, P. & Ray, D. (2001), *Information and Enforcement in Informal Credit Markets*, mimeo, New York University.

Johnstone, D. B. (2004), The Applicability of Income Contingent Loans in Developing and Transitional Countries. *Journal of Educational Planning and Administration*, 18 (2), 159-174.

Johnstone, D. B. (2005), Higher Educational Accessibility and Financial viability: The Role of Student

Loans. In: J. Tres and F. Lopez Segrera (eds.), *Higher Education in the World 2006: The Financing of Universities*, (84-101). Barcelona: Palgrave Macmillan.

Kolm, S-Ch. & Mercier Ythier, J. (2006a), Handbook of the Economics of Giving, Altruism and Reciprocity: Foundations, Vol. 1. In: K. J. Arrow and M. D. Intriligator (eds.), *Handbooks in Economics*, 23, (1-886). Amsterdam: North-Holland.

Kolm, S-Ch. & Mercier Ythier, J. (2006b), Handbook of the Economics of Giving, Altruism and Reciprocity: Applications, Vol. 2. In: K. J. Arrow and M. D. Intriligator (eds.), *Handbooks in Economics*, 23, (887-1588). Amsterdam: North-Holland.

Ledgerwood, J. (1999), *Microfinance Handbook*, 1st edn., Washington, DC: World Bank.
MkNelly, B. & McCord, M. (2001), Womens' Empowerment. *Credit with Education Impact Review*, 1, 1-22.

MkNelly, B. & McCord, M. (2002), Economic Capacity and Security. *Credit with Education Impact Review*, 2, 1-23.

MkNelly, B. & McCord, M. (2003), Children's Nutritional Status. *Credit with Education Impact Review*, 3, 1-19.

Mookherjee, D. & Ray, D. (2008), A Dynamic Incentive-Based Argument for Conditional Transfers. *Economic Record*, 84, S2-S16.

Morduch, J. (1999), The Microfinance Promise. *Journal of Economic Literature*, 37, 1569 – 1614.

Palacios, M. (2004), *Investing in Human Capital: A Capital Markets Approach to Higher Education Funding*, Cambridge: Cambridge University Press.

Stark, O. & Falk, I. (1998), Transfers, Empathy Formation, and Reverse Transfers. *American Economic Review*, 88 (2), 271-276.

Ziderman, A. & Albrecht, D. (1991), *Deferred Cost Recovery for Higher Education: Student Loan Programs in Developing Countries*, World Bank Discussion Paper No. 137, Washington, D.C., World Bank.

Ziderman, A. & Albrecht, D. (1992), *Funding Mechanisms for Higher Education: Financing for Stability, Efficiency, and Responsiveness*, World Bank Discussion Paper No. 153, Washington, D.C., World Bank.

Ziderman, A. & Albrecht, D. (1995), Financing Universities in Developing Countries, *Stanford Series on Education & Public Policy*, 16, Washington: Falmer Press.

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BIOGRAPHY

Dr. Caroline Flammer is an Assistant Professor at Kean University. Her contact information is as follows: Kean University, Department of Graduate Management Studies, Union, NJ 07083. Phone: +1 (908) 737-5983. Email: cflammer@kean.edu.