Informal Finance: A theory of moneylenders

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Introduction

- Author presents a model that analyzes the coexistence of formal and informal finance in underdeveloped credit markets.
- Formal banks have access to unlimited funds but are unable to control the use of credit.
- Informal lenders can prevent non-diligent behavior but often lack the needed capital.
- The theory implies that formal and informal credit can be either complements or substitutes.
- The model also explains why weak legal institutions increase the prevalence of informal finance in some markets and reduce it in others, why financial market segmentation persists, and why informal interest rates can be highly variable within the same sub-economy.

Introduction

Main Assumptions can be summarized as follows :

- Firstly, legal protection of banks is essential to ensure availability of credit.
- Its assume that borrowers may divert their bank loan (ex ante moral hazard) and that weaker contract enforcement increases the value of such diversion, which limits the supply of funds.
- By contrast, informal lenders are able to monitor borrowers by offering credit to a group of known clients where social ties and social sanctions induce investment (Aleem, 1990; Ghate et al., 1992; Udry, 1990)

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- Secondly, while banks have access to unlimited funds, informal lenders can be resource constrained.
- In a survey of financial marketsin developing countries, Conning and Udry (2007) write that "financial intermediation may be held up not for lack of locally informed agents but for lack of local intermediary capital" (Conning and Udry, 2007, p. 2892).
- Consequently, landlords, professional moneylenders, shopkeepers, and traders who offer informal credit frequently acquire bank funds to service borrowers' financing needs.
- Ghate et al. (1992), Rahman (1992), and Irfan et al. (1999) remark that formal credit totals three quarters of the informal sector's liabilities in many Asian countries.

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- Thirdly, less developed economies are often characterized as uncompetitive. In particular, formal sector banks typically have some market power (see Barth et al., 2004; Beck et al., 2004 for contemporary support and Rajan and Ramcharan, 2011; Wang, 2008 for historical evidence).

Introduction

Findings :

- A first set of findings considers how informal credit may improve borrowers' relationship with the banks.
- Informal loans increase the return to productive activities as they cannot be diverted. This lowers the relative gain of misusing formal funds, allowing banks to extend more credit.
- Informal finance thus **complements** the banks by permitting for larger formal loans to poor borrowers.

Introduction

- Secondly, informal lenders' monitoring ability also helps banks to reduce agency cost by letting them channel formal credit through the informal sector.
- When lending directly to poor people, banks share part of the surplus with the borrowers to keep them from diverting.
- Extending credit through informal lenders that are rich enough to have a stake in the outcome minimizes the surplus that banks need to share.
- In contrast to the first result, the credit market becomes segmented as informal finance **substitutes** for banks and limits borrowers' direct bank access.

Model

- Consider a credit market consisting of risk-neutral entrepreneurs (for example, farmers, households, or small firms), banks (who provide formal finance), and moneylenders (who provide informal finance).
- The entrepreneur is endowed with observable wealth $\omega_E \geq 0$.
- She has access to a deterministic production function, $Q(I)$, where I is the investment volume. The production function is concave, twice continuously differentiable, and satisfies $Q(0) = 0$ and $Q'(0) = \infty$
- In a perfect credit market with interest rate r, the entrepreneur would like to attain first-best investment given by $Q'(I^*) = 1 + r$.
- However, she lacks sufficient wealth, $\omega_E < I^*(r)$, and thus turns to the bank and/or the moneylender for the remaining funds.

Model

- While banks have an excess supply of funds, credit is limited as the entrepreneur is unable to commit to invest all available resources into her project. Specifically,author assumes that she may use (part of) the assets to generate non-verifiable private benefits.
- Non-diligent behavior resulting in diversion of funds denotes any activity that is less productive than investment, for example, using available resources for consumption or financial saving.
- The diversion activity yields benefit $\phi < 1$ for every unit diverted. Creditor vulnerability is captured by ϕ (where a higher ϕ implies weaker legal protection of banks).
- Investment is unverifiable, the outcome of the entrepreneur's project in terms of sales revenue may be verified.

Model

- The entrepreneur thus faces the following trade-off:
  - either she invests and realizes the net benefit of production after repaying the bank (and possibly the moneylender)
  - or she profits directly from diverting the bank funds (the entrepreneur still pays the moneylender if she has taken an informal loan)

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- In the case of partial diversion, any remaining returns are repaid to the bank in full.
- The bank does not to derive any benefit from resources that are diverted.

Model

- Informal lenders are endowed with observable wealth $\omega_M \geq 0$ and have a monitoring advantage over banks such that credit granted is fully invested.
- To keep the model tractable, author restricts informal lenders' occupational choice to lending (so no additional income).
- For simplicity, monitoring cost is assumed to zero.
- In the absence of contracting problems between the moneylender and the entrepreneur, the moneylender maximizes the joint surplus derived from the investment project and divides the proceeds using Nash Bargaining

Model

- A contract is given by a pair $(B, R) \in \mathbb{R}_+^2$, where B is the amount borrowed by the entrepreneur and R the repayment obligation.
- If the moneylender requires additional funding he turns to a bank.
- As above, author assumes that the moneylender cannot commit to lend his bank loan and that diversion yields private benefits equivalent of $\phi < 1$ for every unit diverted.
- Lending is unverifiable, the outcome of the moneylender's operation may be verified.
- The moneylender thus faces the following trade-off:
  - either he lends the bank credit to the entrepreneur, realizing the net-lending profit after compensating the bank
  - or he benefits directly from diverting the bank loan.

Model

- Banks have access to unlimited funds at a constant unit cost of zero. They offer a contract (L_i, D_i), where L_i is the loan and D_i the interest payment, with subscripts $i \in E, M$ indicating entrepreneur (E) and moneylender (M).
- When ϕ is equal to zero, legal protection of banks is perfect and even a penniless entrepreneur and/or moneylender could raise an amount supporting first-best investment.
- Assumption :

$$\phi > \underline{\phi} \equiv \frac{Q(I^*(0)) - I^*(0)}{I^*(0)} \tag{1}$$

- In words, the marginal benefit of diversion yields higher utility than the average rate of return to first-best investment at zero rate of interest [henceforth $I^*(0) = I^*$].

Model

- In the competitive benchmark case, author follow Burkart and Ellingsen (2004) by assuming that formal banks offer overdraft facilities of the form $\{L_E, (1+r)L_E\}_{L_E \leq \overline{L}_E}$ where L_E is the loan, $(1+r)L_E$ the repayment, and $\overline{L}_E$ the credit limit.
- The contract implies that a borrower may withdraw any amount of funds until the credit limit binds.
- To distinguish formal from informal finance, I assume that banks are unable to condition their contracts on the moneylender's contract offer, an assumption empirically supported by Giné (2011).
- If not, the entrepreneur could obtain an informal loan and then approach the bank. Bank credit would then depend on the informal loan and the subsequent certain investment.

Model

- The timing is as follows:
  1. Banks offer a contract, (L_i, D_i), to the entrepreneur and the moneylender, respectively.
  2. The moneylender offers a contract, (B, R), to the entrepreneur, where R is settled through Nash Bargaining.
  3. The moneylender makes his lending/diversion decision.
  4. The entrepreneur makes her investment/diversion decision.
  5. Repayments are made.

Equilibrium : Benchmark

- We begin by analyzing each sector in isolation
- There is free entry in the bank market, so the competition drives equilibrium bank profit to zero.
- Nonetheless credit is limited since investment of bank funds cannot be ensured.
- Suppose first that the entrepreneur abstains from diversion. She then draws on the overdraft facility up to the point L_E^u

$$L_E^u = min\{I^*(r) - \omega_E, \overline{L}_E\} \tag{2}$$

i.e. Either the entrepreneur borrows and invests efficiently or she exhausts the credit limit extended by the bank $\overline{L}_E$

Equilibrium : Benchmark

- In the case when the entrepreneur intends to divert resources, the return from diversion is $\phi(\omega_E + L_E - I)$, if she plans to repay the loan in full while diverting. The investment yields at least $1 + r$ on every dollar of the available assets, which exceeds the diversion benefit of $\phi < 1$.
- By contrast, if the entrepreneur invests an amount not sufficient to repay in full, there is no reason to invest either borrowed, L_E, or internal funds, ω_E, since the bank would claim all of the returns upon default.

Equilibrium : Benchmark

- Solving for the subgame-perfect equilibrium outcome, the entrepreneur chooses I and L_E by maximizing
  $U_E = max\{0, Q(I) - (1+r)L_E\}$
  subject to
  $Q(I) - (1+r)L_E \geq \phi(\omega_E + \overline{L}_E)$
  $\omega_E + L_E \geq I$
  $\overline{L}_E \geq L_E$
  objective function shows the profit from investing, accounting for limited liability.
- The first constraint is the incentive-compatibility condition versus the bank. The second condition requires that investment cannot exceed available funds, while the third inequality states that bank borrowing is constrained by the credit limit.
- In sum, the entrepreneur acts diligently if the contract satisfies

$$Q(\omega_E + L_E^u) - (1+r)L_E^u \geq \phi(\omega_E + \overline{L}_E) \tag{3}$$

Equilibrium : Benchmark

- As there is no default in equilibrium, the only equilibrium interest rate consistent with zero profit is $r = 0$.
- At low wealth, the temptation to divert resources is too large to allow a loan in support of first best. In this case, the credit limit is given by the binding incentive constraint

$$Q(\omega_E + L_E^u) - L_E^u = \phi(\omega_E + \overline{L}_E) \tag{4}$$

- When the entrepreneur is sufficiently wealthy the constraint no longer binds and the first-best outcome is obtained.

Equilibrium : Benchmark

Lemma A2

$Q'(\omega_E + \overline{L}_E - (1+\phi) < 0$

Proof. When the entrepreneur (henceforth E) borrows from a competitive bank and the credit limit binds,

$$Q(\omega_E + \overline{L}_E) - \overline{L}_E - \phi(\omega_E + \overline{L}_E) = 0. \quad \text{(A1)}$$

This constraint is only binding if $Q'(\omega_E + \overline{L}_E) - (1+\phi) < 0$. Otherwise, $\overline{L}_E$ could be increased without violating the constraint. □

Equilibrium : Benchmark

Proposition 1

For all $\phi > \underline{\phi}$ there is a threshold $\omega_E^c > 0$ such that entrepreneurs with wealth below ω_E^c invest $I < I^*$, credit (L_E) and investment (I) increase in ω_E and decrease in creditor vulnerability (ϕ). If $\omega_E \geq \omega_E^c$ then I^* is invested.

Proof:

- In addition to the point discussed before, we now do comparative static results and check for the existence and the uniqueness of ω_E^c

Proof of Proposition 1:

Lemma A3. There exists a unique threshold $\omega_E^c(\phi) > 0$ such that $Q(\omega_E + \overline{L}_E) - \overline{L}_E - \phi(\omega_E + \overline{L}_E) = 0$ for $\omega_E = \omega_E^c(\phi)$ and $\omega_E + \overline{L}_E = I^*$.

Proof. The threshold ω_E^c is the smallest wealth level that satisfies $\omega_E + \overline{L}_E = I^*$. As Eq. (A1) yields the maximum incentive-compatible investment level, ω_E^c satisfies

$$Q(I^*) - I^*(1 + \phi) + \omega_E^c = 0 \qquad \text{(A2)}$$

The threshold is unique if $\overline{L}_E$ is increasing in ω_E. Differentiating Eq. (A1) with respect to $\overline{L}_E$ and ω_E I obtain

$$\frac{d\overline{L}_E}{d\omega_E} = \frac{\phi - Q'(\omega_E + \overline{L}_E)}{Q'(\omega_E + \overline{L}_E) - (1 + \phi)} > 0,$$

where the inequality follows from Lemma A2, $Q'(I) \geq 1$, and $\phi < 1$. Finally, $\omega_E^c > 0$ is a result of the assumption that $\phi > \underline{\phi}$ [Eq. (1)]. □

Proof of Proposition 1:

Lemma A4. If $\omega_E \leq \omega_E^c$ then L_E and I increase in ω_E and decrease in ϕ.

Proof. The proof that $d\overline{L}_E/d\omega_E > 0$ is provided in Lemma A3. As Eq. (A1) also determines the investment level, $dI/d\omega_E > 0$ follows. Differentiating Eq. (A1) with respect to $\overline{L}_E$ and ϕ I obtain

$$\frac{d\overline{L}_E}{d\phi} = \frac{\omega_E + \overline{L}_E}{Q'(\omega_E + \overline{L}_E) - (1+\phi)} < 0,$$

where the inequality follows from Lemma A2. As Eq. (A1) also determines the investment level, $dI/d\phi < 0$ follows. □

Equilibrium : Benchmark

- If the entrepreneur borrows from the informal sector, the moneylender maximizes the surplus of the investment project $Q(\omega_E + B) - B$
- Let B^* denote the loan size that solves the first-order condition $Q'(\omega_E + B) - 1 \geq 0$, where $B^* = min\{I^* - \omega_E, \omega_M\}$.
- Absent contracting frictions, the efficient outcome is obtained if the moneylender is sufficiently wealthy, while the outcome is constrained efficient otherwise.
- Given B^*, the entrepreneur and the moneylender bargain over how to share the project gains using available resources $\omega_E + B$. If they disagree, investment fails and each party is left with her/his wealth or potential loan.
- In case of agreement, the moneylender offers a contract where the equilibrium repayment using the Nash Bargaining solution.
- The assets represent the disagreement point of each respective agent.

Equilibrium : Benchmark

$$\begin{aligned} R(B)^* &= argmax\{Q(\omega_E + B) - t - \omega_E\}^{\alpha}\{t - B\}^{1-\alpha} \\ &= (1-\alpha)[Q(\omega_E + B) - \omega_E] + \alpha B \end{aligned}$$

where α represents the degree of competition in the informal sector (competition increases if α is high).

- Following Binmore et al. (1986) and Binmore et al. (1989), author assumes that the entrepreneur's option of investing her own money only becomes a constraint when her share of the bargaining outcome is less than the value of pursuing the project on her own,i.e. α satisfies $\alpha > \tilde{\alpha}$, where $\tilde{\alpha}$ solves

$$\alpha[Q(\omega_E + B) - B] + (1-\alpha)\omega_E = Q(\omega_E) \tag{5}$$

Equilibrium : Formal and informal finance

- Financial sector coexistence not only allows poor borrowers to raise funds from two sources, but it also permits informal lenders to access banks.
- This introduces additional trade-offs :
  - On the one hand, (agency-free) informal credit improves the incentives of the entrepreneur as informal finance increases the residual return to the entrepreneur's project, with the end effect equivalent to a boost in internal funds.
  - On the other hand, banks now have to consider the possibility of diversion on part of the entrepreneur and the moneylender.

Equilibrium : Formal and informal finance

Solving backwards and starting with the entrepreneur's incentive constraint yields

$$Q(\omega_E + L_E^u + B) - L_E^u - R(B) \geq \phi(\omega_E + \overline{L}_E) \tag{6}$$

where $L_E^u = min\{I^* - \omega_E - B, \overline{L}_E\}$ The only modification from above is that the amount borrowed from the moneylender, B, is prudently invested. If the moneylender needs extra funds, he turns to a bank and chooses the amount to lend to the entrepreneur, B, and the amount of credit, LM, to satisfy the following incentive constraint

$$R(\omega_M + L_M^u) - L_M^u \geq \phi(\omega_M + \overline{L}_M) \tag{7}$$

where $R(B)$ is a function of the amount lent to the entrepreneur with $L_M^u = min\{I^* - \omega_M - \omega_E - L_E^u, \overline{L}_M\}$
The repayment using the Nash Bargaining solution : as before, we have

$$R(B)^* = (1 - \alpha)[Q(\omega_E + L_E^u + B) - L_E^u - \omega_E] + \alpha B \tag{8}$$

Equilibrium : Formal and informal finance

Now we characterize the resulting equilibrium constellations.

- Poor entrepreneurs and poor moneylenders will be credit rationed by the bank as their stake in the financial outcome is too small.
- Since the surplus of the bank transaction accrues entirely to the entrepreneur and the moneylender, the residual return to investment increases if both take bank credit.
- Specifically, the entrepreneur exhausts her bank credit line and borrows the maximum amount made available by the moneylender. Similarly, the moneylender utilizes all available bank funds and his own capital to service the entrepreneur.

Equilibrium : Formal and informal finance

Hence, the credit limits solve the following binding constraints of the entrepreneur and the moneylender

$$\alpha[Q(I) - \overline{L}_E - \overline{L}_M - \omega_M] + (1-\alpha)\omega_E = \phi(\omega_E + \overline{L}_E) \tag{9}$$

$$(1-\alpha)[Q(I) - \overline{L}_E - \overline{L}_M - \omega_E] + \alpha\omega_M = \phi(\omega_M + \overline{L}_M) \tag{10}$$

with $I = \omega_E + \overline{L}_E + \omega_M + \overline{L}_M$

With financial sector coexistence author makes the additional assumption that α satisfies $\alpha > \hat{\alpha}$. The threshold $\hat{\alpha}$, denotes the point of indifference between exclusive bank borrowing and obtaining bank and moneylender funds and is determined by

$$\alpha[Q(I) - \overline{L}_E - \overline{L}_M - \omega_M] + (1-\alpha)\omega_E = Q(\omega_E + \overline{L}_E) - \overline{L}_E \tag{11}$$

Equilibrium : Formal and informal finance

- When the moneylender becomes wealthier, the net return from extending a loan exceeds the diversion gain, and his incentive constraint becomes slack.
- As the moneylender borrows at marginal cost, competition with the formal bank sector implies that he makes zero profit
- Rationale: Poor moneylenders charge positive rates of interest even if they keep a low share of the bargaining outcome (when α is close to 1). This is because they need to be compensated for the incentive rent received from banks to prevent opportunistic behavior. By contrast, as sufficiently wealthy moneylenders are not tempted by diversion and obtain formal funds at marginal cost they earn no rent in equilibrium.

Equilibrium : Formal and informal finance

- Hence, the entrepreneur's credit limit solves independent of the bargaining outcome

$$Q(\omega_E + \overline{L}_E + \omega_M + \overline{L}_M) - \overline{L}_E - \omega_M - \overline{L}_M = \phi(\omega_E + \overline{L}_E) \qquad (12)$$

  while the investment is given by $I = I^*$

- If the moneylender is rich enough to self finance large parts/the entire amount of first best he no longer acquires bank funds. Here the entrepreneur borrows from a bank and a self-financed moneylender.
- The entrepreneur's incentive constraint is still determined by Eq. (12), with $L_M + \omega_M$ replaced by $B \leq \omega_M$ and $I = I^*$
- Finally, a sufficiently rich entrepreneur resorts to the bank alone, with $I = I^*$

  Note : Author assumes that entrepreneur accepts the first available contract if indifferent.

Equilibrium : Formal and informal finance

Proposition 2

For all $\alpha > \hat{\alpha}, \phi > \underline{\phi}$
(i) $\omega_E < \omega_E^c$, entrepreneurs borrow from a bank and a bank-financed moneylender and invest $I < I^*$ if $\omega_M < \underline{\omega}_M^c$ and I^* if $\omega_M \in [\underline{\omega}_M^c, \overline{\omega}_M^c)$.
Entrepreneurs borrow from a bank and a self-financed moneylender and invest I^* if $\omega_M \geq \overline{\omega}_M^c$
(ii) $\omega_E \geq \omega_E^c$ entrepreneurs borrow exclusively from a bank and invest I^*

When weak institutions constrain banks, informal finance allows poor borrowers (with wealth below ω_E^c) to invest more than if banks were the only source of funds.
Entrepreneurs with wealth above ω_E^c are unaffected as they can satisfy their needs with bank credit alone.

Proof of Proposition 2 :

Lemma A5. There exist unique thresholds $\omega_E^c(\phi) > 0$, $\underline{\omega}_M^c(\alpha, \phi)$, $\overline{\omega}_M^c(\alpha, \phi)$, and $\hat{\alpha}$ such that:

(i) $Q(\omega_E + \overline{L}_E) - \overline{L}_E - \phi(\omega_E + \overline{L}_E) = 0$ for $\omega_E = \omega_E^c(\phi)$ and $\omega_E + \overline{L}_E = I^*$;

(ii) $\alpha[Q(\omega_E + \overline{L}_E + \omega_M + \overline{L}_M) - \overline{L}_E - \overline{L}_M - \omega_M] + (1-\alpha)\omega_E - \phi(\omega_E + \overline{L}_E) = 0$ and $(1-\alpha)[Q(\omega_E + \overline{L}_E + \omega_M + \overline{L}_M) - \overline{L}_E - \overline{L}_M - \omega_E] + \alpha\omega_M - \phi(\omega_M + \overline{L}_M) = 0$ for $\omega_M = \underline{\omega}_M^c(\alpha, \phi)$ and $\omega_E + \overline{L}_E + \omega_M + \overline{L}_M = I^*$;

(iii) $Q(\omega_E + \overline{L}_E + \omega_M) - \overline{L}_E - \omega_M - \phi(\omega_E + \overline{L}_E) = 0$ for $\omega_M = \overline{\omega}_M^c(\alpha, \phi)$ and $\omega_E + \overline{L}_E + \omega_M = I^*$;

(iv) $\overline{\omega}_M^c(\alpha, \phi) > \underline{\omega}_M^c(\alpha, \phi) > 0$; and

(v) $\hat{\alpha} \in (0, 1)$.

Proof. Part (i): The proof is provided in Lemma A3.

Part (ii): The threshold $\underline{\omega}_M^c$ is the smallest wealth level that satisfies $\omega_E + \overline{L}_E + \omega_M + \overline{L}_M = I^*$ when E and the moneylender (henceforth

M) utilize bank funds as given by Eqs. (9) and (10) in the main text. Using Eqs. (9) and (10) to solve for the maximum incentive-compatible investment level I have that, for a given level of E's wealth, ω_E, $\underline{\omega}_M^c$ satisfies

$$Q(I^*) - I^*(1+\phi) + \omega_E + \underline{\omega}_M^c = 0. \tag{A3}$$

The threshold is unique if both $\overline{L}_E$ and $\overline{L}_M$ are increasing in ω_M. Differentiating Eqs. (9) and (10) with respect to $\overline{L}_E$, $\overline{L}_M$, and ω_M using Cramer's rule I obtain

$$\frac{d\overline{L}_E}{d\omega_M} = \frac{\alpha\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} > 0$$

and

$$\frac{d\overline{L}_M}{d\omega_M} = \frac{\phi\left[Q'(I) - \phi\right] - \alpha\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} > 0,$$

where the inequalities follow from Lemma A2, $Q'(I) \geq 1$, and $\phi < 1$.

Equilibrium : Formal and informal finance

Part (iii): The threshold $\overline{\omega}_M^c$ is the smallest wealth level that satisfies $\omega_E + \overline{L}_E + \omega_M = I^*$ at which M is able to self finance E. Thus, for a given level of E's wealth, ω_E, $\overline{\omega}_M^c$ satisfies

$$Q(I^*) - I^*(1+\phi) + \omega_E + \overline{\omega}_M^c \phi = 0. \tag{A4}$$

The threshold is unique if $\overline{L}_E$ (L_M) is independent of (decreasing in) ω_M when the relevant constraints are given by Eq. (12) in the main text and the first-order condition $Q'(I) - 1 = 0$. Differentiating Eq. (12) and the first-order condition with respect to $\overline{L}_E$, L_M, and ω_M using Cramer's rule I obtain

$$\frac{d\overline{L}_E}{d\omega_M} = 0$$

and

$$\frac{dL_M}{d\omega_M} = -1.$$

Equilibrium : Formal and informal finance

Part (iv): Combining Eqs. (A3) and (A4), yields $\underline{\omega}_M^c = \phi\overline{\omega}_M^c$, where $\overline{\omega}_M^c > \underline{\omega}_M^c$ follows from $\phi < 1$. Finally, $\omega_E^c > 0$ is a result of the assumption that $\phi > \underline{\phi}$ [Eq. (1)].

Part (v): Solving for $\hat{\alpha}$ using Eq. (11) in the main text I have that

$$\hat{\alpha} = \frac{Q(\omega_E + \overline{L}_E) - \omega_E - \overline{L}_E}{Q(\omega_E + \overline{L}_E + \omega_M + \overline{L}_M) - \omega_E - \overline{L}_E - \omega_M - \overline{L}_M}. \tag{A5}$$

By concavity and $Q'(I) \geq 1$, the denominator always exceeds the nominator in Eq. (A5). Hence, $\hat{\alpha} < 1$. Similarly, $\hat{\alpha} > 0$ follows from concavity and $Q'(I) \geq 1$. □

Equilibrium : Formal and informal finance

Lemma A6. If (i) $\omega_E < \omega_E^c$ and $\omega_M < \overline{\omega}_M^c$ then the entrepreneur borrows from a bank and a bank-financed moneylender. If (ii) $\omega_E < \omega_E^c$ and $\omega_M \geq \overline{\omega}_M^c$ then the entrepreneur borrows from a bank and a self-financed moneylender. If (iii) $\omega_E \geq \omega_E^c$ then the entrepreneur borrows exclusively from a bank.

Proof. I consider E's and M's incentive constraints given that the bank breaks even. Five distinct cases need to be analyzed as E may borrow

Equilibrium : Formal and informal finance

from: (i) the bank exclusively; (ii) the bank and a bank-financed M; (iii) a bank-financed M exclusively; (iv) a self-financed M exclusively; (v) the bank and a self-financed M.

Part (i): First, consider $\omega_M < \underline{\omega}_M^c$. Recognizing the concavity of $Q(I)$ and $Q'(I) \geq 1$, it follows that E and M prefer Case (ii) to Cases (iii)–(v) for any α. Finally, for $\alpha > \hat{\alpha}$ as defined in Eq. (A5), E prefers Case (ii) to Case (i) as well. Next, when $\omega_M \in [\underline{\omega}_M^c, \overline{\omega}_M^c)$, $\omega_E + \omega_M$ accounts for the interval of credit lines such that $\omega_M < I^* - \omega_E - L_E$, for a given ω_E and ω_E. From the main text we have that Case (ii) leaves E with the full surplus, while M is indifferent and so Case (ii) remains the equilibrium outcome when $\omega_M \in [\underline{\omega}_M^c \overline{\omega}_M^c)$.

Part (ii): Here, $\omega_E + \omega_M$ accounts for the interval of credit lines such that $\omega_M \geq I^* - \omega_E - L_E$, for a given ω_E and ω_M. The only difference from Part (ii) is that M refrains from bank borrowing when he is able to self finance large parts of the first-best investment, making Case (ii) irrelevant. Thus, Case (v) is the only possible outcome since in Cases (iii) and (iv), E would have to share part of a (possibly smaller) surplus with M.

Part (iii): As E turns to the bank first and is able to satisfy first best, Case (i) is the outcome. □

Equilibrium : Formal and informal finance

Corollary 1

For $\alpha > \hat{\alpha}$, $\omega_E < \omega_E^c$, and:
(i) $\omega_M < \underline{\omega}_M^c$, credit ($\overline{L}_E$) increases in entrepreneurs' wealth (ω_E),decreases in creditor vulnerability (ϕ), and is nondecreasing in moneylenders' wealth (ω_M), while $\overline{L}_M$ is nondecreasing in ω_E, decreases in ϕ, and increases in ω_M;
(ii) $\omega_M \in [\underline{\omega}_M^c, \overline{\omega}_M^c)$, $\overline{L}_E$ increases in ω_E, is independent of ω_M, and decreases in ϕ, while L_M decreases in ω_i and increases in ϕ.

A rise in wealth allows poor entrepreneurs and poor moneylenders to take additional bank credit if they share the project's surplus.

Equilibrium : Formal and informal finance

Proof of Corollary 1:

Proof. For $\omega_M < \underline{\omega}_M^c$, $\omega_E < \omega_E^c$, and $\alpha > \hat{\alpha}$: Differentiating Eqs. (9) and (10) in the main text with respect to $\overline{L}_E, \overline{L}_M, \omega_E, \omega_M$, and ϕ using Cramer's rule I obtain

$$\frac{d\overline{L}_E}{d\omega_E} = \frac{\phi\left[Q'(I) - \phi\right] - (1-\alpha)\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} > 0,$$

$$\frac{d\overline{L}_M}{d\omega_E} = \frac{(1-\alpha)\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} \geq 0,$$

$$\frac{d\overline{L}_E}{d\phi} = \frac{(\omega_E + \overline{L}_E)\left\{(1-\alpha)\left[Q'(I) - 1\right] - \phi\right\} - (\omega_M + \overline{L}_M)\alpha\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} < 0,$$

and

$$\frac{d\overline{L}_M}{d\phi} = \frac{(\omega_M + \overline{L}_M)\left\{\alpha\left[Q'(I) - 1\right] - \phi\right\} - (\omega_E + \overline{L}_E)(1-\alpha)\left[Q'(I) - 1\right]}{\phi\left[1 + \phi - Q'(I)\right]} < 0,$$

where the inequalities follow from Lemma A2, $Q'(I) \geq 1$, and $\phi < 1$. The proof that $d\overline{L}_E/d\omega_M \geq 0$ and $d\overline{L}_M/d\omega_M > 0$ is provided in Lemma A5.

For $\omega_M \in [\underline{\omega}_M^c, \overline{\omega}_M^c)$, $\omega_E < \omega_E^c$, and $\alpha > \hat{\alpha}$: The relevant constraints are given by Eq. (12) in the main text and the first-order condition $Q'(I) - 1 = 0$. Differentiating Eq. (12) and the first-order condition with respect to $\overline{L}_E$, L_M, ω_E, ω_M, and ϕ using Cramer's rule I obtain

$$\frac{d\overline{L}_E}{d\omega_E} = \frac{1-\phi}{\phi} > 0,$$
$$\frac{dL_M}{d\omega_E} = \frac{-1}{\phi} < 0,$$
$$\frac{d\overline{L}_E}{d\phi} = \frac{-(\omega_E + \overline{L}_E)}{\phi} < 0,$$

and

$$\frac{dL_M}{d\phi} = \frac{\omega_E + \overline{L}_E}{\phi} > 0,$$

where the first inequality follows from $\phi < 1$. The proof that $d\overline{L}_E/d\omega_M = 0$ and $dL_M/d\omega_M < 0$ is provided in Lemma A5. □

Equilibrium : Formal and informal finance

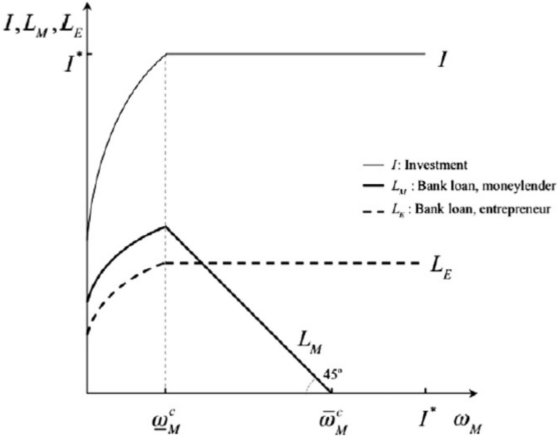

Fig. 1. Competitive bank credit and moneylender wealth.

Equilibrium : Imperfect Bank Competition

- Informal lenders' monitoring ability also helps banks to reduce agency cost by allowing them to channel credit through the informal sector.
- To show this, formal banks need some market power. We first look at the case without informal lenders and then characterize the outcome under financial sector coexistence.

Equilibrium : Imperfect Bank Competition

The bank sets L_E and D_E by maximizing
$D_E - L_E$
subject to the participation constraint
$Q(\omega_E + L_E) - D_E \geq Q(\omega_E)$
and the incentive constraint given by
$Q(\omega_E + L_E) - D_E \geq \phi(\omega_E + L_E)$
For low levels of wealth, the incentive constraint binds and the bank's profit may be written as $Q(\omega_E + L_E) - \phi(\omega_E + L_E) - L_E$
The first-order condition of the profit expression determines the optimal loan size

$$Q'(\omega_E + L_E) - (1 + \phi) = 0 \tag{13}$$

while D_E is determined by

$$Q(\omega_E + L_E) - D_E = \phi(\omega_E + L_E) \tag{14}$$

Equilibrium : Imperfect Bank Competition

- A salient feature of this outcome is that entrepreneurs are provided a constant floor rent above their outside option to satisfy the investment level, $I = \omega_E + L_E$, given by Eq. (13).(PC does not bind)
- Since higher wealth is met by a parallel decrease in credit to maintain the sub-optimal investment, any wealth improvement is pocketed by the bank.
- Poor entrepreneurs are thus prevented from accumulating assets.
- As wealth climbs, the participation and the incentive constraint hold simultaneously. A higher debt capacity permits the bank to increase the repayment obligation such that the entrepreneur is indifferent between taking credit and self financing the project.

Equilibrium : Imperfect Bank Competition

- Since first best is unattainable, the loan size continues to satisfy the incentive constraint.
- Hence, the repayment is determined by the binding participation constraint, while the equilibrium loan size solves

$$Q(\omega_E) = \phi(\omega_E + L_E) \tag{15}$$

- For rich entrepreneurs only the participation constraint binds and first best is obtained

Equilibrium : Imperfect Bank Competition

Proposition 3

For all $\phi > \underline{\phi}$,there are thresholds $\overline{\omega}_E^m > \underline{\omega}_E^M > 0$ such that:
(i) entrepreneurs with wealth below $\underline{\omega}_E^M$ invest $I = I'$ as given by Eq. (13), credit (L_E) decreases in ω_E, and I' is independent of ω_E; if $\omega_E \in [\underline{\omega}_E^m, \overline{\omega}_E^m)$, then $I \in [I', I^*)$ is invested and L_E and I increase in ω_E ; if $\omega_E \geq \overline{\omega}_E^m$ then I^* is invested;
(ii) market power reduces efficiency, that is, $\overline{\omega}_E^m > \omega_E^c$

Bank market concentration reduces lending and investment. Intuitively, when increasing the price, the bank lowers the borrower's incentive to repay. Hence, high interest rates must be coupled with less lending and consequently lower investment. As a large repayment burden increases both the bank's payoff and the entrepreneur's incentive to default, poor customers earn rent to avoid diversion of bank credit.

Proof of Proposition 3:

Lemma A7. There exist unique thresholds $\underline{\omega}_E^m(\phi)$ and $\overline{\omega}_E^m(\phi)$ such that:

(i) $\phi(\omega_E + L_E) - Q(\omega_E) = 0$ for $\omega_E = \underline{\omega}_E^m(\phi)$ and $\omega_E + L_E = I$, with the investment level given by Eq. (13) in the main text;

(ii) $\phi(\omega_E + L_E) - Q(\omega_E) = 0$ for $\omega_E = \overline{\omega}_E^m(\phi)$ and $\omega_E + L_E = I^*$; and

(iii) $\overline{\omega}_E^m(\phi) > \underline{\omega}_E^m(\phi) > 0$ and $\overline{\omega}_E^m(\phi) > \omega_E^c(\phi)$.

Proof. Part (i): The threshold $\underline{\omega}_E^m$ is the smallest wealth level at which E's incentive constraint equals her participation constraint allowing E to invest $\omega_E + L_E = I$, with I given by Eq. (13) in the main text. Thus, $\underline{\omega}_E^m$ satisfies

$$\phi I - Q(\underline{\omega}_E^m) = 0. \tag{A6}$$

Equilibrium : Imperfect bank competition

The threshold is unique if L_E is decreasing in ω_E when the equilibrium is given by Eqs. (13) and (14) in the main text. Differentiating Eqs. (13) and (14) with respect to L_E and ω_E using Cramer's rule I obtain

$$\frac{dL_E}{d\omega_E} = -1.$$

Finally, $\underline{\omega}_E^m > 0$ follows from the assumption that $\phi > \underline{\phi}$.
Part (ii): The proof is analogous to the proof of Part (ii) and omitted.
Part (iii): Solving for $\underline{\omega}_E^m$ and $\overline{\omega}_E^m$ and combining the two expressions, yields $Q(\overline{\omega}_E^m)I' = Q(\underline{\omega}_E^m)I^*$, with I' given by Eq. (13) in the main text. By concavity, $I^* > I'$ and hence $\overline{\omega}_E^m > \underline{\omega}_E^m$. Solving for ω_E^c and $\overline{\omega}_E^m$ and combining the two expressions, yields $Q(I^*) - I^* = Q(\overline{\omega}_E^m) - \omega_E^c$, where $\overline{\omega}_E^m > \omega_E^c$ follows from concavity. $\square$

Equilibrium : Imperfect bank competition

Lemma A8. If $\omega_E \le \underline{\omega}_E^m$ then L_E decreases in ω_E and I is independent of ω_E; if $\omega_E \in (\underline{\omega}_E^m, \overline{\omega}_E^m)$ then L_E and I increase in ω_E.

Proof. When $\omega_E \le \underline{\omega}_E^m$, the proof that $dL_E/d\omega_E < 0$ is provided in Lemma A7. Differentiating Eqs. (13) and (14) in the main text and the investment condition, $\omega_E + L_E = I$, with respect to I and ω_E using Cramer's rule I obtain

$$\frac{dI}{d\omega_E} = 0.$$

When $\omega_E \in (\underline{\omega}_E^m, \overline{\omega}_E^m)$, the relevant constraints are given by Eq. (15) in the main text, the binding participation constraint, $Q(\omega_E + L_E) - D_E = Q(\omega_E)$, and the investment condition, $\omega_E + L_E = I$. Differentiating Eq. (15), the binding participation constraint, and the investment condition with respect to L_E, I, and ω_E using Cramer's rule I obtain

$$\frac{dL_E}{d\omega_E} = \frac{Q'(\omega_E) - \phi}{\phi} > 0$$

and

$$\frac{dI}{d\omega_E} = \frac{Q'(\omega_E)}{\phi} > 0,$$

where the first inequality follows from $Q'(I) \ge 1$ and $\phi < 1$. □

Equilibrium : Imperfect Bank Competition

- The existence of moneylenders modifies this trade-off. Informal lenders' monitoring advantage implies that channeled bank capital saves the incentive rent the bank otherwise share with poor entrepreneurs.
- Still, forwarded bank money comes at a cost as the bank forgoes part of its surplus to prevent being cheated by the moneylenders.
- We restrict our attention to the range of wealth levels where entrepreneurs receive the bank's floor utility, $\omega_E < \omega_E^m$.
- Note : The threshold ω_E^m is the wealth level at which the entrepreneurs' incentive and participation constraint both bind. It differs from $\overline{\omega}_E^m$, as the investment corresponding to ω_E^m also depends on the moneylender's wealth.
- Specifically, if the entrepreneur and the moneylender are poor the bank lends to both. They receive floor contracts giving them utility above their outside option of pursuing the entrepreneur's project on their own.

Equilibrium : Imperfect Bank Competition

The binding incentive constraints and the first-order condition of the bank's profit expression determine credit extended, L_E and L_M, and the aggregate repayment D.

$$\alpha[Q(I) - D - \omega_M] + (1 - \alpha)\omega_E = \phi(\omega_E + L_E) \tag{16}$$

$$(1 - \alpha)[Q(I) - D - \omega_E] + \alpha\omega_M = \phi(\omega_M + L_M) \tag{17}$$

$$Q'(I) - (1 + \phi) = 0 \tag{18}$$

with $I = \omega_E + L_E + \omega_M + L_M$

The bank charges a price, $D = D_E + D_M$, paid in proportion to the share of the surplus kept by each borrower.

Informal finance permits the bank both to decrease the entrepreneur's net surplus and to minimize the aggregate loan supporting the sub-optimal investment. The bank refrains from channeling the entire loan through the informal sector, however, since the moneylender's temptation to divert formal credit is too large.

Equilibrium : Imperfect Bank Competition

- As the informal lender's debt capacity improves, his participation and incentive constraint both bind at some point. The increase in moneylender wealth allows the bank to reduce the poor entrepreneur's part of the aggregate loan to save on the incentive rent shared with her to prevent diversion.
- Specifically, for the same level of investment [given by Eq. (18)], L_E is decreased in step with a climbing ω_M until the entire loan is extended to the moneylender, giving rise to credit market segmentation. The moneylender's repayment obligation D_M solves the binding participation constraint.

Equilibrium : Imperfect Bank Competition

$$(1-\alpha)[Q(I)-D_M-\omega_E]+\alpha\omega_M=(1-\alpha)[Q(\omega_E+\omega_M)-\omega_E]+\alpha\omega_M \quad (19)$$

while the equilibrium loan size L_M satisfies

$$(1-\alpha)[Q(\omega_E+\omega_M)-\omega_E]+\alpha\omega_M=\phi(\omega_M+L_M) \quad (20)$$

with $I=\omega_E+\omega_M+L_M$

The participation constraint ensures the utility associated with the moneylender self financing the project.

A rich enough moneylender is able to support first best. Eq. (19) determines D_M and $I=I^*$.

Finally, if the moneylender is sufficiently wealthy to self finance the investment, the bank and the moneylender compete in the same fashion as described by Eq. (12).

Proposition 4

For all $\alpha > \tilde{\alpha}, \phi > \underline{\phi}$ and $\omega_E < \omega_E^m$
(i) entrepreneurs borrow from a bank and a bank-financed moneylender and invest $I = I'$ as given by Eq. (18) if $\omega_M < \underline{\omega}_M^m$
(ii) entrepreneurs borrow exclusively from a bank-financed moneylender and invest $I \in [I', I^*)$ if $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$ and I^* if $\omega_M \in [\overline{\omega}_M^m, I^* - \omega_E)$;
(iii) entrepreneurs borrow from a bank and a self-financed moneylender and invest I^* if $\omega_M \geq I^* - \omega_E$;

Proof of Proposition 4:

Lemma A9. There exist unique thresholds $\omega_E^m(\alpha,\phi) > 0$, $\omega_M^m(\alpha,\phi)$, $\overline{\omega}_M^m(\alpha,\phi)$, and $\widetilde{\alpha}$ such that:

(i) $\phi(\omega_E + L_E) - \alpha Q(\omega_E + B) - (1-\alpha)\omega_E + \alpha B = 0$ for $\omega_E = \omega_E^m(\alpha,\phi)$ and $\omega_E + L_E + B = I$, with the investment level given by Eq. (18) in the main text;

(ii) $\phi(\omega_M + L_M) - (1-\alpha)[Q(\omega_E + \omega_M) - \omega_E] - \alpha\omega_M = 0$ *for* $\omega_M = \underline{\omega}_M^m(\alpha,\phi)$ and $\omega_E + \omega_M + L_M = I$, with the investment level given by Eq. (18) in the main text;

(iii) $\phi(\omega_M + L_M) - (1-\alpha)[Q(\omega_E + \omega_M) - \omega_E] - \alpha\omega_M = 0$ for $\omega_M = \overline{\omega}_M^m(\alpha,\phi)$ and $\omega_E + \omega_M + L_M = I^*$;

(iv) $\overline{\omega}_M^m(\alpha,\phi) > \underline{\omega}_M^m(\alpha,\phi) > 0$; and

(v) $\widetilde{\alpha} \in (0,1)$.

Equilibrium : Imperfect bank competition

Proof. Part (i): The threshold ω_E^m is the smallest wealth level at which E's incentive constraint equals her participation constraint allowing E to invest $\omega_E + L_E + B = I$, with I given by Eq. (18) in the main text. Thus, for a given level of M's wealth, ω_M, ω_E^m satisfies

$$\phi(I-B)-\alpha Q(\omega_E^m+\omega_M)-(1-\alpha)\omega_E^m+\alpha\omega_M=0. \tag{A7}$$

The threshold is unique if $L_E + L_M$ decrease in ω_E when the equilibrium is given by Eqs. (16) to (18) in the main text. {The same reasoning applies when $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$.} Differentiating Eqs. (16) to (18) with respect to L_E, L_M, and ω_E using Cramer's rule I obtain

$$\frac{dL_E}{d\omega_E}=\frac{1-\alpha-\phi}{\phi}$$

and

$$\frac{dL_M}{d\omega_E}=\frac{\alpha-1}{\phi},$$

with $dL_E/d\omega_E + dL_M/d\omega_E = -1$. To show $\omega_E^m > 0$, let $\alpha = \tilde{\alpha}$ in Eq. (A7) where $\tilde{\alpha}$ is given by Eq. (5) in the main text. This yields $\phi(I-B) - Q(\omega_E^m) = 0$, where $\omega_E^m > 0$ follows from the assumption that $\phi > \underline{\phi}$. Then let $\alpha = 1$. Here, $\phi(I-B) - Q(\omega_E^m + \omega_M) + \omega_M = 0$. Note that ω_E^m decreases in ω_M for $\omega_M < I^* - \omega_E$. As ω_M approaches $I^* - \omega_E$, I have that $\phi(I^* - \omega_M) - Q(I^*) + I^* - \omega_E^m = 0$, which is identical to Eq. (A4). If $\omega_E^m = 0$ then $\omega_M = I^*$, but this contradicts $\overline{\omega}_M^c < I^*$. Hence, $\omega_E^m > 0$.

Equilibrium : Imperfect bank competition

Part (ii): The threshold ω_M^m is the smallest wealth level at which M's incentive constraint equals his participation constraint allowing an investment of $\omega_E + \omega_M + L_M = I$, with I given by Eq. (18) in the main text. Thus, for a given level of E's wealth, ω_E, $\underline{\omega}_M^m$ satisfies

$$\phi(I-\omega_E)-(1-\alpha)\left[Q\left(\omega_E+\underline{\omega}_M^m\right)-\omega_E\right]-\alpha\underline{\omega}_M^m=0. \tag{A8}$$

The threshold is unique if $L_E + L_M$ decrease in ω_M when the equilibrium is given by Eqs. (16) to (18) in the main text. Differentiating Eqs. (16) to (18) with respect to L_E, L_M, and ω_M using Cramer's rule I obtain

$$\frac{dL_E}{d\omega_M}=\frac{-\alpha}{\phi}$$

and

$$\frac{dL_M}{d\omega_M}=\frac{\alpha-\phi}{\phi},$$

with $dL_E/d\omega_M + dL_M/d\omega_M = -1$.

Equilibrium : Imperfect bank competition

Part (iii): The threshold $\overline{\omega}_M^m$ is the smallest wealth level at which M's incentive constraint equals his participation constraint allowing an investment of $\omega_E + \omega_M + L_M = I^*$. Thus, for a given level of E's wealth, ω_E, $\overline{\omega}_M^m$ satisfies

$$\phi(I^* - \omega_E) - (1-\alpha)\left[Q\left(\omega_E + \overline{\omega}_M^m\right) - \omega_E\right] - \alpha\overline{\omega}_M^m = 0. \tag{A9}$$

The threshold is unique if L_M is increasing in ω_M when the equilibrium is given by Eqs. (19) and (20) in the main text. Differentiating Eqs. (19) and (20) with respect to L_M and ω_M using Cramer's rule I obtain

$$\frac{dL_M}{d\omega_M} = \frac{(1-\alpha)Q'(\omega_E + \omega_M) + \alpha - \phi}{\phi} > 0,$$

where the inequality follows from $Q'(I) \geq 1$ and $\phi < 1$.
Part (iv): Combining Eqs. (A8) and (A9), yields $\left(I' - \omega_E\right)\{(1-\alpha)\times [Q(\omega_E + \overline{\omega}_M^m) - \omega_E] + \alpha\overline{\omega}_M^m\} = (I^* - \omega_E)\{(1-\alpha)\left[Q\left(\omega_E + \underline{\omega}_M^m\right) - \omega_E\right] + \alpha\underline{\omega}_M^m\}$, with I' given by Eq. (18) in the main text, and hence $\overline{\omega}_M^m > \omega_M^m$.
Finally, $\underline{\omega}_M^m > 0$ follows from the assumption that $\phi > \underline{\phi}$.
Part (v): The proof is provided in the main text. □

Equilibrium : Imperfect bank competition

Lemma A10. If (i) $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$ then the entrepreneur borrows from a bank and a bank-financed moneylender. If (ii) $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$ then the entrepreneur borrows exclusively from a bank-financed moneylender. If (iii) $\omega_E < \omega_E^m$ and $\omega_M \geq I^* - \omega_E$ then the entrepreneur borrows from a bank and a self-financed moneylender.

Proof. I consider the bank's utility given that the relevant (incentive or participation) constraint of E and M is satisfied.

Part (i): There are two distinct cases to consider when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$. First, if the incentive constraints of E and M bind, the bank prefers lending to both rather than only one of them as this minimizes the aggregate loan size needed to satisfy I' [given by Eq. (18) in the main text]. When M's participation and incentive constraint hold simultaneously, the bank can either: (i) scale up the loan to E and M, allowing the investment to rise above I'; or (ii) maintain $I = I'$ by reallocating the loan from E to M in response to an increase in M's wealth. Suppose Case (i) is a candidate equilibrium, as defined by Eqs. (16) to (18) in the main text. An increase in ω_M allows the bank to increase L_M to the point at which M's incentive constraint equals his participation constraint. M's additional loan raises E's investment return and permits a larger loan to E as well. Hence, an increase in M's wealth increases the bank's utility by (differentiating $U_{Bank} = Q(I) - (1-\alpha)[Q(\omega_E + \omega_M) - \omega_E] - \alpha\omega_M - \phi(\omega_E + L_E) - L_E - L_M$ with respect to ω_M)

$$\frac{dU_{Bank}}{d\omega_M} = \frac{Q'(\omega_E + \omega_M)\left[Q'(I) - (1+\phi)\right] + \phi}{\phi},$$

where $Q'(I) < 1 + \phi$ as $I > I'$. Meanwhile, Case (ii) implies that an increase in ω_M is met by an increase in L_M and a subsequent decrease in L_E satisfying $dL_M/d\omega_M + d\omega_M/d\omega_M = -\,dL_E/d\omega_M$.

Equilibrium : Imperfect bank competition

Differentiating the bank's utility with respect to ω_M in this case yields

$$\frac{dU_{Bank}}{d\omega_M} = 1 > \frac{Q'(\omega_E + \omega_M)\left[Q'(I) - (1+\phi)\right] + \phi}{\phi}.$$

Hence, when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$, E borrows from the bank and a bank-financed M with $\omega_E + L_E + \omega_M + L_M = I'$.
Part (ii): When $\omega_E < \omega_E^m$ and $\omega_M \in [\omega_M^m, I^* - \omega_E)$ the only difference from Part (i) is that M's debt capacity has improved, allowing the bank to extend the entire loan to M as this saves the incentive rent otherwise shared with E.
Part (iii): When $\omega_E < \omega_E^m$ and $\omega_M \geq I^* - \omega_E$, M is able to self finance first-best investment and the same outcome as described in Part (ii), Lemma A6 is obtained. □

Equilibrium : Imperfect bank competition

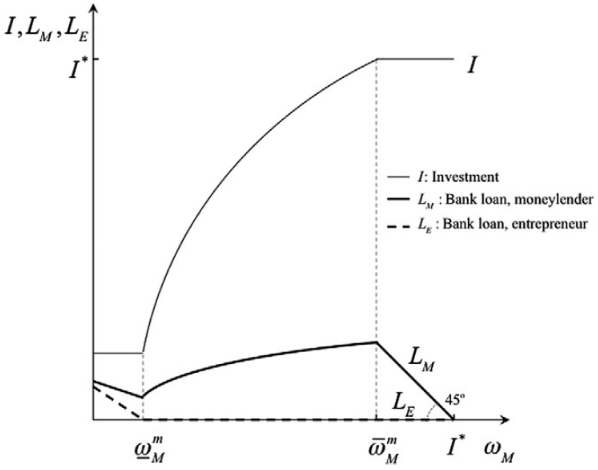

Fig. 2. Uncompetitive bank credit and moneylender wealth.

Equilibrium : Imperfect Bank Competition

Observations:

- While informal finance raises bank-rationed borrowers' investment, it also limits formal sector access. As moneylenders become richer, banks are able to reduce the surplus otherwise shared with poor entrepreneurs.
- This contrasts with and complements the findings of Proposition 2 and Corollary 1.
  - On the one hand, informal finance complements banks by allowing more formal capital to reach borrowers directly.
  - On the other hand, informal lenders substitute for banks by acting as a formal credit channel.
- The extent to which either effect dominates depends on the degree of competition in the formal bank sector.

Equilibrium : Imperfect Bank Competition

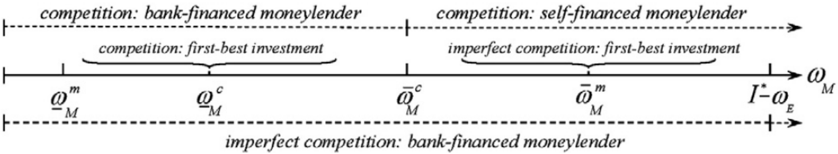

Fig. 3. Moneylender wealth thresholds across the banking regimes.

Fig. illustrates that bank market competition both increases efficiency ($\underline{\omega}_M^c < \overline{\omega}_M^m$) and reduces the amount of formal funding channeled by the moneylenders ($\underline{\omega}_M^c < I^* - \omega_E$)

Cross Sectional Predictions

Ratio of informal credit to investment $\frac{B}{I} = \frac{\omega_M + \overline{L}_M}{\omega_E + \overline{L}_E + \omega_M + \overline{L}_M}$

Proposition 5

For bank-rationed entrepreneurs, the ratio of informal credit to investment is:
(i) increasing in creditor vulnerability (ϕ), decreasing in entrepreneurs' wealth (ω_E), and independent of moneylenders' wealth (ω_M) if banks are competitive and $\omega_M \geq \underline{\omega}_M^c$
(ii) nonincreasing ϕ in for $\omega_M \geq \underline{\omega}_M^m$, decreasing in ω_E for $\omega_M < \underline{\omega}_M^m$ and for $\omega_M \geq \overline{\omega}_M^m$, and nondecreasing in ω_M if banks have market power and $\omega_M < I^* - \omega_E$

Cross Sectional Predictions

- In the case of credit market segmentation: If bank-rationed moneylenders are the only providers of entrepreneurial credit, worse legal protection causes banks to cut the funding of the informal sector to avoid diversion i.e., the fraction B/I decreases in ϕ.
- At first best, more efficient institutions are irrelevant for B/I since diversion no longer tempts the moneylender. These opposing effects may explain the indeterminacy found in some of the data with respect to the relation between rule of law and the size of the informal sector

Proof of Proposition 5:

Proof. Differentiating the ratio of informal credit to investment, B/I, with respect to ϕ, ω_E, and ω_M yields $r_\phi = [(dL_M/d\phi)I - (dI/d\phi)B]/I^2$, $r_{\omega_E} = [(dL_M/d\omega_E)I - (dI/d\omega_E)B]/I^2$, and $r_{\omega_M} = \{[d(\omega_M + L_M)/d\omega_M]I - (dI/d\omega_M)B\}/I^2$, respectively. Investment is unaffected by variation in ϕ, ω_E, and ω_M (ω_E and ω_M) at first best (when it is given by Eq. (18) in the main text).

Part (i): When $\omega_E < \omega_E^c$ and $\omega_M \geq \underline{\omega}_M^c$, $r_\phi = (dL_M/d\phi)/I > 0$, $r_{\omega_E} = (dL_M/d\omega_E)/I < 0$, and $r_{\omega_M} = (1 + dL_M/d\omega_M)/I = 0$, using the comparative statics established in Corollary 1.

Part (ii): First, I derive the relevant comparative statics. When $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$, the constraints are given by Eqs. (19) and (20) in the main text. Differentiating Eqs. (19) and (20) with respect to L_M, I, and ϕ using Cramer's rule I obtain $dL_M/d\phi = dI/d\phi = -B/\phi < 0$. When $\omega_E < \omega_E^m$ and $\omega_M \in [\overline{\omega}_M^m, I^* - \omega_E)$, the constraints are given by Eq. (19) in the main text and the first-order condition $Q'(I) - 1 = 0$. Differentiating Eq. (19) and the first-order condition with respect to L_M, ω_E, and ω_M using Cramer's rule I obtain $dL_M/d\omega_E = dL_M/d\omega_M = -1$. Next, I determine the ratios. When $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$, then $r_{\omega_E} = (dL_M/d\omega_E)/I < 0$ and $r_{\omega_M} = (1 + dL_M/d\omega_M)/I > 0$, using the comparative statics established in Lemma A9. If $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$, then $r_\phi = -B\omega_E/\phi I^2 < 0$ and $r_{\omega_M} = \left[(1-\alpha)Q'(\omega_E + \omega_M) + \alpha\right] \times \omega_E/\phi I^2 > 0$, using the comparative statics established above and in Lemma A9. If $\omega_E < \omega_E^m$ and $\omega_M \in [\overline{\omega}_M^m, I^* - \omega_E)$, then $r_\phi = r_{\omega_M} = 0$ and $r_{\omega_E} = -1/I < 0$, using the comparative statics established above. □

Empirical Evidence

- The equilibrium analysis in Propositions 2 and 4 highlights the interaction between weak institutions, poor agents, and inefficient markets.
- The finding that borrowers' formal sector debt capacity increases in their wealth is consistent with a series of empirical studies on formal–informal sector interactions in Africa (Graham et al., 1988; Steel et al., 1997), Asia (Banerjee and Duflo, 2007; Bell et al., 1997; Floro and Yotopoulos, 1991; Giné, 2011), and South America (Conning, 2001; Key, 1997).
- Giné's study of 2880 households and 606 small businesses in rural Thailand, the richest borrowers (measured both by wealth and income) access the formal sector exclusively. As wealth declines, borrowers resort either to informal lenders (including landlords, professional moneylenders, traders, and store owners) alone or to both financial sectors.
- A similar pattern emerges when investigating informal lenders' formal sector debt capacity. In a survey of 96 wholesalers and retail merchants in Niger, Graham et al. report that the size of retail merchants' formal sector loan increases in their asset base.

Empirical Evidence

- Several case studies illustrate the complementarity between formal and informal finance.
- In particular, local traders and input suppliers, drawing on funds from banks and upstream buyers, often provide farmers with inputs and credit in the form of cash and in-kind loans on machinery, seeds, and fertilizers. (Reardon and Timmer 2007)
- In these instances, informal lenders' capital base not only raises investment but also enables borrowers to draw on additional formal finance.
- Campion documents that Peru's artichoke processors and input suppliers "provide valuable finance to help farmers to produce high quality artichokes in greater quantity and improve their returns on investment. Higher returns have lead to greater access to formal finance..." (Campion, 2006, p. 10)
- Wittlinger and Tuesta's (2006) : Paraguay's Soybean farmers in Paraguay sell their produce to and receive credit from upstream silos that actively oversee the production process. This phase-by-phase supervision means that the bank officers spend less time monitoring the loan, allowing for more formal capital to be lent directly to the farmers. Moreover, the silos also take bank loans to finance fertilizers, fuel, and agricultural equipment provided as in-kind inputs to the farmers.

Empirical Evidence

- The empirical regularity that wealthier informal lenders often are the exclusive clients of formal banks (rather than poor borrowers) supports the prediction that banks may prefer to channel their capital through the informal sector.
- In Philippine agricultural finance, Floro and Yotopoulos (1991) note that formal lenders and upstream buyers rarely deal directly with smaller borrowers. Instead, the formal lenders rely on rich farmer-clients as "they [the rich farmers] have the assets required for leverage"
- Rahman (1992) reports that although formal credit totals more than two thirds of the informal sector's liabilities in Bangladesh, less than ten percent of the households borrow directly from the formal sector. Similarly, . Those that take formal credit (and on lend) are "people with sufficient collateral and credibility to borrow from formal sector financial institutions"
- Harriss (1983) in her study of 400 agricultural traders and paddy producers in Tamil Nandu, India where large farmers take formal credit to be on lent to poorer clients.
- Evidence from Japan's Meiji era (1868–1912) shows a similar pattern. During this period, wealthier grain, fertilizer, or textile merchants, landlords, and professional moneylenders obtained bank credit to finance poor farmers, weavers, and silk producers otherwise unable to secure external funding (Teranishi, 2005, 2007)

Empirical Evidence

- In the model, the degree of bank competition affects formal financial sector access as well as the role of informal lenders.
- From the historical evidence from Plymouth County in New England, United States (Wang, 2008):
  - Bank records show that merchants, esquires, and gentlemen (the rich) accounted for most of the transactions when the county comprised one bank. Meanwhile, the court records of debt claims identify the same wealthy group as providers of credit to farmers and artisans.
  - After the entry of an additional bank, the proportion of bank loans to merchants declined from 60 to 25% while farmers and artisans increased their share from 12 to 38%. The court records also show that farmers and artisans were less likely to borrow from wealthy merchants.

Empirical Evidence

- Contemporary data echo these findings.
- Giné's (2011) study of formal–informal sector interactions in Thailand, poor borrowers are less likely to access the informal sector exclusively when bank competition increases.
- Burgess and Pande's (2005) investigation of the effects of bank branch expansion in India (effectively, increased formal sector competition) shows a similar pattern. They find that bank borrowing as a share of total rural household debt increased from 0.3 to 29% between 1961 and 1991. Meanwhile, borrowing from professional moneylenders fell from 61 to 16 % in the same period.

Empirical Evidence

- The model suggests that that weaker legal institutions increase the prevalence of informal credit if borrowers obtain money from both financial sectors, while the opposite is true if informal lenders supply all funds.
- Using firm-level data for 26 countries in Eastern Europe and Central Asia, Dabla-Norris and Koeda (2008) broadly confirm Proposition 5. They show that the relationship between legal institutions and informal credit is indeterminate, while bank lending contracts as creditor protection worsens.
- Study by Chavis et al. (2009) covering 70,000 small and medium-sized firms in over 100 countries shows that improvements in creditor protection have a positive effect on access to bank finance, particularly for young (and small) firms.
- Dabla-Norris and Koeda and Chavis et al. also find that the use of informal finance is consistently higher in lower-income countries. If entrepreneurial wealth is a proxy for income, this is line with the model's prediction that informal finance grows in importance as borrower wealth declines.

Concluding Remarks

- The extent to which informal finance complements or substitutes for bank credit depends on banks' bargaining power. If formal banks are competitive, borrowers obtain capital from both financial sectors, with poor informal lenders accessing banks for extra funds. By contrast, if formal lenders have some market power, sufficiently rich (bank-financed) informal lenders are borrowers' only source of credit.
- Weaker legal institutions increase the prevalence of informal credit if borrowers obtain money from both financial sectors, while the opposite is true if informal lenders supply all capital
- Persistence of financial underdevelopment, in the form of market segmentation, happens as wealthier informal lenders (and banks) prefer the segmented outcome that arises with bank market power, as it softens competition between the financial sectors.
- We also saw that informal credit complements as well as substitutes for formal finance.