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Informal finance: A theory of moneylenders☆,☆☆

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ABSTRACT

I present 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.

1. Introduction

Formal and informal finance coexist in markets with weak legal institutions and low levels of income (Germidis et al., 1991; Nissanke and Aryeetey, 1998). Poor people either obtain informal credit or borrow from both financial sectors at the same time. Banerjee and Duflo (2007) document that 95% of all borrowers living below $2 a day in Hyderabad, India access informal sources even when banks are present.[1] Meanwhile, Das-Gupta et al. (1989) provide evidence from Delhi, India where 70% of all borrowers get credit from both sectors at the same time.[2] Such financing arrangements raise a number of issues. Why do some borrowers take informal loans despite the existence of formal banks, while others obtain funds from both financial sectors simultaneously? Also, is there a causal link between institutional development, level of income, and informal lending? If so, precisely what is the connection?

Although empirically important, the coexistence of formal and informal finance has not received as much attention as recent theoretical work on microfinance (Banerjee et al., 1994; Ghatak and Guinnane, 1999; Rai and Sjöström, 2004). In this paper, I provide a theory of informal finance, whose main assumptions can be summarized as follows.

First, in line with the literature on the effect of institutions on economic performance (Djankov et al., 2007; La Porta et al., 1997, 1998; Visaria, 2009), I view legal protection of banks as essential to ensure availability of credit. To this end, I 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).[3]

Second, while banks have access to unlimited funds, informal lenders can be resource constrained. In a survey of financial markets

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[1] See Siamwalla et al. (1990) for similar findings from Thailand.

[2] See Conning (2001) and Giné (2011) for related support from Chile and Thailand.

[3] For further evidence of the personal character of informal lending see Udry (1994), Steel et al. (1997), and La Ferrara (2003) for the case of Africa and Bell (1990) for the case of Asia. As in Besley and Coate (1995), my aim is not to explain informal lenders' monitoring ability, but to understand its implications.

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in 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.[4]

Third, 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).[5]

Within this framework, I show that informal finance affects poor people's access to credit in two main ways. In the model, formal banks are restrained by borrowers' inability to commit to using funds for productive purposes. The agency problem is more acute for the poor as the benefit of diversion increases in the size of the loan. While informal lenders' monitoring advantage allows them to lend to bank-rationed borrowers they may not have the necessary resources in which case they also turn to the formal sector for additional funds.

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.

Second, 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.

I find that 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. This is because borrowers' and informal lenders' joint return is maximized if both take competitive bank loans, while bank market power and subsequent credit market segmentation allows the formal monopoly to reduce agency costs.

The predictions are broadly consistent with existing data on formal–informal sector interactions. (See Section 5 for an extensive discussion.) The characterization of the aggregate demand for and supply of formal and informal credit also allows me to address some additional issues. For example, 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. Moreover, the interest rates of informal lenders rise as credit markets become segmented.

Persistence of financial underdevelopment, in the form of market segmentation, can also be understood within the model. Wealthier informal lenders (and banks) prefer the segmented outcome that arises with bank market power, as it softens competition between the financial sectors. Finally, my analysis sheds some light on credit market policy by distinguishing between the efficiency effects of wealth transfers, credit subsidies, and legal reform.

The paper relates to several strands of the literature. First, it adds to work that views informal lenders either as bank competitors (Bell et al., 1997; Jain, 1999; Jain and Mansuri, 2003) or as a channel of bank funds (Bose, 1998; Floro and Ray, 1997; Hoff and Stiglitz, 1998). While these papers share the notion that informal lenders hold a monitoring advantage over banks, there are a number of important differences. First, in earlier work it is not clear whether informal lenders compete with banks or primarily engage in channeling funds. Second, competition theories cannot account for bank lending to the informal sector. Third, channeling theories fail to address the agency problem between the formal and the informal lender.

The present paper explains why informal lenders take bank credit in each of these instances, making competition and channeling a choice variable in a framework where monitoring problems exist between banks, informal lenders, and borrowers. Allowing for both competition and channeling thus extends and reconciles existing approaches. By deriving endogenous constraints on informal lending, I am able to account for the empirical regularity that informal credit complements as well as substitutes for formal finance.

Finally, an advantage over earlier work is the tractability of the basic agency model which delivers the simple insight that less leveraged borrowers are better credit risks (as in the costly effort setup).[6] The framework presented is well suited to take on additional characteristics relevant to understand formal and informal sector interactions such as differences in enforcement capacity, the importance of legal institutions, and market power; features which are missing in earlier contributions.

The second line of related literature studies the interaction between modern and traditional sectors to rationalize persistence of personal exchange (Banerjee and Newman, 1998; Besley et al., 2012; Kranton, 1996; Rajan, 2009).[7] My results also match Biais and Mariotti's (2009) and von Lilienfeld-Toal et al.'s (2012) findings of heterogeneous effects of improved creditor rights across rich and poor agents. Finally, the paper links to research emphasizing market structure as an important cause of contractual frictions in less developed economies (Kranton and Swamy, 2008; Mookherjee and Ray, 2002; Petersen and Rajan, 1995).[8]

The model builds on Burkart and Ellingsen's (2004) analysis of trade credit in a competitive banking and input supplier market.[9] The bank and the borrower in their model are analogous to the competitive formal lender and the borrower in my setting. However, their input supplier and my informal lender differ substantially.[10] Also, in contrast to Burkart and Ellingsen, by considering credit-rationed informal lenders and bank market power, the model distinguishes whether informal lenders compete with banks or engage in channeling formal bank funds.

Section 2 introduces the model and Section 3 presents equilibrium outcomes. Section 4 deals with cross-sectional predictions, persistence

[4] Conning and Udry (2007) further write that "the trader-intermediary usually employs a combination of her own equity together with funds leveraged from less informed outside intermediaries such as banks…[leading] to the development of a system of bills of exchange…[used by the] outside creditor…as security" (Conning and Udry, 2007, pp. 2863–2864). See Harriss (1983), Bouman and Houtman (1988), Graham et al. (1988), Floro and Yotopoulos (1991), and Mansuri (2006) for additional evidence of informal lenders accessing the formal sector in India, Niger, Pakistan, Philippines, and Sri Lanka. See also Haney (1914), Gates (1977), Biggs (1991), Toby (1991), Teranishi (2005, 2007), and Wang (2008) for historical support from Japan, Taiwan, and the United States.

[5] Beck et al. report a positive and significant relation between measures of bank competition and GDP per capita.

[6] See Banerjee (2003) for a discussion of the similarity across different moral hazard models of credit rationing.

[7] While Kranton and Banerjee and Newman focus on how market imperfections give rise to institutions that (may) impede the development of markets, Besley et al. and Rajan (like this paper) show how rent protection can hamper reform.

[8] As in Petersen and Rajan and Mookherjee and Ray, I study the effects of market power on credit availability, while Kranton and Swamy investigate the implications on hold-up between exporters and textile producers.

[9] Burkart and Ellingsen assume that it is less profitable for the borrower to divert inputs than to divert cash. Thus, input suppliers may lend when banks are limited due to potential agency problems.

[10] While the input supplier and the (competitive) bank offer a simple debt contract, the informal lender offers a more sophisticated project-specific contract, where the investment and the subsequent repayment are determined using Nash Bargaining. More importantly, the informal lender is assumed to be able to ensure that investment is guaranteed, something that the trade creditor is unable to do.

of market segmentation, and informal interest rates. Section 5 examines empirical evidence. Section 6 explores economic policy. I conclude by discussing robustness issues and point to possible extensions. Formal proofs are in the Appendix.

2. 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.[11]

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, I assume that she may use (part of) the assets to generate nonverifiable 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). While investment is unverifiable, the outcome of the entrepreneur's project in terms of output and/or sales revenue may be verified. 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). 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.

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, I restrict informal lenders' occupational choice to lending (additional sources of income do not alter the main insights). For simplicity, monitoring cost is assumed to zero.[12] The moneylender's superior knowledge of local borrowers grants *him* exclusivity (but not necessarily market power, see below).[13] 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. 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. Finally, if the moneylender requires additional funding he turns to a bank.

Following the same logic as above, I assume that the moneylender cannot commit to lend his bank loan and that diversion yields private benefits equivalent of $\phi < 1$ for every unit diverted. While 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.

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. To make the problem interesting, I assume that

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

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 $I^*(0) = I^*$].

In the competitive benchmark case, I follow Burkart and Ellingsen (2004) by assuming that formal banks offer overdraft facilities of the form $\{(L_E, (1+r)L_E)\}_{L_E \leq \bar{L}_E}$, where L_E is the loan, $(1 + r)\, L_E$ the repayment, and $\bar{L}_E$ the credit limit. The contract implies that a borrower may withdraw any amount of funds until the credit limit binds.[14]

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).[15] 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.[16] 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.

Note finally that the informal sector contains a variety of lenders including input suppliers, landlords, merchants, professional moneylenders, and traders. Through their occupation, they attract different borrowers (for example, trader/farmer and landlord/tenant) that may give some lenders a particular enforcement advantage. The important and uniting feature, however, is the ability to induce diligent behavior irrespective of the quality of the legal system. In the analysis that follows, the moneylender represents all informal lenders with this trait.

3. Equilibrium

I begin by analyzing each financial sector in isolation. This helps understand how the agency problem in the formal bank market generates credit rationing. It also highlights how the provision of incentives and the quality of the legal system affect lending across the two sectors.

3.1. Benchmark

There is free entry in the bank market. Following a Bertrand argument, competition drives equilibrium bank profit to zero.[17] Nonetheless,

[11] I assume that the entrepreneur accepts the first available contract if indifferent between the contracts offered.

[12] This is not to diminish the importance of informal lenders' monitoring cost (see Banerjee, 2003). However, the cost is set to zero as it makes no difference in the analysis that follows (unless sufficiently prohibitive to prevent banks or entrepreneurs from dealing with the informal sector altogether).

[13] The assumption that borrowers obtain funds from at most one informal source has empirical support see, for example, Aleem (1990), Siamwalla et al. (1990), and Berensmann et al. (2002).

[14] As showed by Burkart and Ellingsen (2004), this restriction is without loss of generality as no other contract can upset an equilibrium in overdraft facilities.

[15] This is in contrast to Burkart and Ellingsen (2004), who assume that banks and trade credit suppliers offer simultaneous contracts. Allowing the informal sector to contract on the bank provides informal lenders a more active intermediary role, similar to the monitor in hierarchical agency (principal–monitor–agent) models. See Mookherjee (2012) for an overview of this literature.

[16] See also Bell et al. (1997) for evidence in support of the assumed sequence of events.

[17] Some developing credit markets have a sizable share of state-owned banks. I make no assumption on bank ownership but do assume that profit maximization governs bank behavior. While state ownership can be less efficient (La Porta et al., 2002) this does not bar profit maximization as a useful approximation. In Sapienza's (2004) study of Italian banks, state-owned enterprises charge less but increase interest rates when markets become more concentrated, consistent with profit-maximizing behavior.

credit is limited since investment of bank funds cannot be ensured. To see this, suppose first that the entrepreneur abstains from diversion. She then draws on the overdraft facility up to the point L_E^u, where

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

Either the entrepreneur borrows and invests efficiently, $I^*(r)$, or she exhausts the credit limit extended by the bank, $\bar{L}_E$. 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.[18] Hence (solving for the subgame-perfect equilibrium outcome), the entrepreneur chooses the amount of funds to invest, I, and the amount of credit, L_E, by maximizing

$$U_E = \max\{0, Q(I) - (1+r)L_E\}$$

subject to

$$\begin{aligned} Q(I) - (1+r)L_E &\geq \phi(\omega_E + \bar{L}_E), \\ \omega_E + L_E &\geq I, \\ \bar{L}_E &\geq L_E. \end{aligned}$$

The objective function shows the profit from investing, accounting for limited liability. The first constraint is the incentive-compatibility condition versus the bank, which prevents the entrepreneur from diverting the internal funds as well as the maximum credit raised. 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

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

where L_E^u is given by Eq. (2). 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

$$Q(\omega_E + \bar{L}_E) - \bar{L}_E = \phi(\omega_E + \bar{L}_E). \tag{4}$$

As an increase in wealth improves the return to investment for a given loan size, the credit line and the investment rise with wealth. Similarly, better creditor protection (a lower ϕ) increases the opportunity costs of diversion, making larger repayment obligations and thus higher credit limits incentive compatible. When the entrepreneur is sufficiently wealthy the constraint no longer binds and the first-best outcome is obtained.

Proposition 1. For all $\phi > \phi$ 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.

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.[19] 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. The assets represent the disagreement point of each respective agent. By remaining liquid throughout the bargaining they can start the project if they agree or decide to stop negotiating and take their wealth to pursue other alternatives. In case of agreement, the moneylender offers a contract where the equilibrium repayment, using the Nash Bargaining solution, is

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

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), I assume 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.[20] For simplicity, α satisfies $\alpha > \tilde{\alpha}$, where $\tilde{\alpha}$ solves

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

with $\alpha \in (\tilde{\alpha}, 1)$.[21] The left-hand side of the equality is the entrepreneur's utility of borrowing from the moneylender, while the right-hand side denotes the value of the stand-alone investment. As the empirical evidence on the extent of informal lenders' market power is inconclusive, no a priori assumption is made on α other than that.[22]

3.2. 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.

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

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

where $L_E^u = \min\{I^* - \omega_E - B, \bar{L}_E\}$. The only modification from above is that the amount borrowed from the moneylender, B, is prudently invested.[23]

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, L_M, to satisfy the following incentive constraint

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

[18] Because output is observable, the bank captures any return from production.

[19] Excess moneylender funds are deposited in the bank earning a zero rate of interest.

[20] The rationale is that only threats that are credible will have an effect on the outcomes. The outside options are only used as constraints on the range of the validity of the Nash Bargaining solution, with the disagreement point placed on the impasse point (ω_E, B). That is, the entrepreneur can only threaten to proceed with her stand-alone investment, or deal herself out of the bargaining, if it gives her a bigger pay-off than dealing herself in. See Sutton (1986) for a further discussion of how to specify the outside option in non-cooperative bargaining models.

[21] From concavity and $Q'(I) \geq 1$ it follows that $\tilde{\alpha} \in (0, 1)$.

[22] Informal finance has been documented as competitive (Adams et al., 1984), monopolistically competitive (Aleem, 1990), and as a monopoly (Bhaduri, 1977).

[23] Since returns are claimed by the bank even if the bank's credit has been diverted, it is never optimal for the entrepreneur to borrow from the moneylender while diverting bank funds.

where $R(B)$ is a function of the amount lent to the entrepreneur for any pair (L_M^u, ω_M), with $L_M^u = \min\{I^* - \omega_M - \omega_E - L_E^u, \bar{L}_M\}$. The left-hand side of the inequality is the moneylender's net-lending profit, while the right-hand side is the return from borrowing a maximum amount and then diverting all available assets.[24]

It remains to determine the repayment using the Nash Bargaining solution. As before, I have

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

the only difference is that each party is compensated for the cost of bank borrowing. I now 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. Hence, the credit limits solve the following binding constraints of the entrepreneur and the moneylender

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

and

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

with $I = \omega_E + \bar{L}_E + \omega_M + \bar{L}_M$. With financial sector coexistence I make the additional assumption that α satisfies $\alpha > \hat{\alpha}$. The threshold, $\hat{\alpha} > 0$, denotes the point of indifference between exclusive bank borrowing and obtaining bank and moneylender funds and is determined by

$$\alpha\left[Q(I) - \bar{L}_E - \bar{L}_M - \omega_M\right] + (1-\alpha)\omega_E = Q\left(\omega_E + \bar{L}_E\right) - \bar{L}_E.^{25} \tag{11}$$

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.[26] Hence, the entrepreneur's credit limit solves *independent* of the bargaining outcome

$$Q\left(\omega_E + \bar{L}_E + \omega_M + L_M\right) - \bar{L}_E - L_M - \omega_M = \phi\left(\omega_E + \bar{L}_E\right), \tag{12}$$

while the investment is given by $I = I^*$.[27] If the moneylender is rich enough to self finance large parts (or 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 $B \le \omega_M$ and $I = I^*$.[28] Finally, a sufficiently rich entrepreneur resorts to the bank alone, with $I = I^*$.

Proposition 2. For all $\alpha > \hat{\alpha}$, $\phi > \underline{\phi}$, and:

- **(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 $\omega_M \ge \overline{\omega}_M^c$;
- **(ii)** $\omega_E \ge \omega_E^c$, 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. Meanwhile, entrepreneurs with wealth above ω_E^c are unaffected as they can satisfy their needs with bank credit alone. To better understand how the informal sector's asset base matters, I explore how the credit lines change with the underlying parameters.

Corollary 1. For $\alpha > \hat{\alpha}$, $\omega_E < \omega_E^c$, and:

- **(i)** $\omega_M < \underline{\omega}_M^c$, credit $(\bar{L}_E)$ increases in entrepreneurs' wealth (ω_E), decreases in creditor vulnerability (ϕ), and is nondecreasing in moneylenders' wealth (ω_M), while $\bar{L}_M$ is nondecreasing in ω_E, decreases in ϕ, and increases in ω_M;
- **(ii)** $\omega_M \in [\underline{\omega}_M^c, \overline{\omega}_M^c)$, $\bar{L}_E$ 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 [wealth below $\underline{\omega}_M^c$ and ω_E^c and $\alpha \in (\hat{\alpha}, 1)$]. In particular, a boost in moneylender wealth makes the entrepreneur's investment of a given bank loan more valuable than the diversion of the loan, inducing an increase in the entrepreneur's bank credit. Fig. 1 illustrates how the credit lines respond to changes in the informal lender's capital base (assuming the entrepreneur is rationed by the bank). As ω_M increases so does bank credit extended to both the entrepreneur and the moneylender. The result hinges on the informal sector's ability to enforce the transaction, not on being better at attracting bank funds. Indeed, worse legal protection raises the profitability of diversion relative to lending the bank credit, limiting the moneylender's bank access. At first best [attained at $\underline{\omega}_M^c$ in Fig. 1], additional informal sector wealth becomes less important as a higher ω_M has no effect on the entrepreneur's incentives (depicted by the constant L_E for $\omega_M \ge \underline{\omega}_M^c$).[29] Unlike above, weaker legal institutions increase the importance of the informal sector as diversion no longer tempts the moneylender (L_M increases in ϕ). Since sufficiently rich moneylenders earn the opportunity cost of funds, informal sector market power only matters at wealth below $\underline{\omega}_M^c$ and ω_E^c. Although equilibrium outcomes remain the same for $\hat{\alpha} < \alpha \le 1$, some variation

[24] Similar to the entrepreneur, the moneylender faces a binary choice. If he decides to lend all his bank funds in order to repay in full, he earns at least 1, while diversion grants him only ϕ. If he lends too little to repay the bank loan in full, he may as well divert all funds, since additional returns are claimed by the bank.

[25] Note that Eq. (11) implies that remaining with the bank and the moneylender is utility equivalent to leaving the bargaining and taking the assets, ω_E, to pursue a stand-alone investment with the bank. Hence, the credit limit that solves Eq. (4) above also has to satisfy Eqs. (9) and (10) for $\alpha = \hat{\alpha}$.

[26] The more detailed argument why the moneylender earns a zero profit is based on contradiction and goes as follows: suppose there exist a project surplus that exceeds the sum of the entrepreneur's and the moneylender's outside option and the moneylender keeps part of the surplus. The bank can then offer the entrepreneur more credit which increases her value of diversion and reduces the surplus shared with the moneylender. If the surplus is positive, the entrepreneur refrains from diversion in equilibrium, while the moneylender concedes by lowering his price of credit. This is because the entrepreneur never takes informal credit while diverting bank funds, as additional returns are claimed by the bank. The process continues until the moneylender obtains his outside option, contradicting the initial claim.

[27] The entrepreneur's credit limit cannot be lower in equilibrium. Otherwise, there would exist a bank contract with a lower limit and a positive informal interest rate preferred by the bank as well as the moneylender.

[28] The entrepreneur could satisfy her needs by only taking informal credit but borrows from both sectors as I assume that she accepts the first available contract if indifferent. The same conclusion follows if moneylenders' monitoring cost was positive and constant returns to scale.

[29] Instead, hikes in ω_M are fully compensated by decreases in L_M, while climbing ω_E leads to higher $\bar{L}_E$ (as the entrepreneur's incentive constraint becomes less binding) and consequently lower L_M.

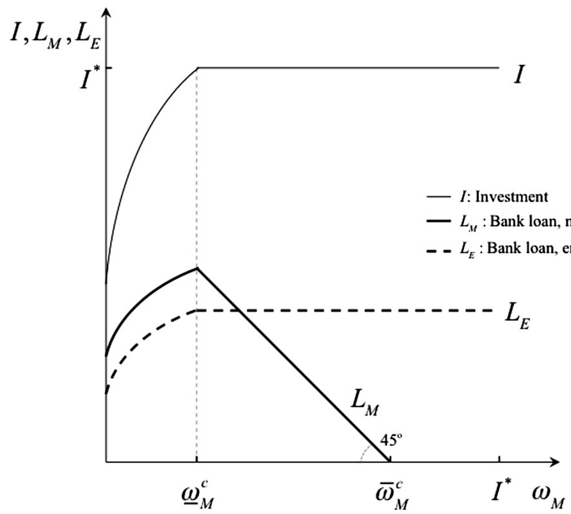

Fig. 1. Competitive bank credit and moneylender wealth.

is muted. If informal credit is perfectly competitive ($\alpha = 1$), $\overline{L}_M$ is independent of ω_E.[30]

The modeling choice of one moneylender is a useful simplification to capture that informal lending is a local activity that rests on moneylenders' superior knowledge of their clients. From this follows the (empirically motivated) assumption of exclusivity. Exclusivity does not imply that informal lenders have market power however. As showed above, the scarcity of informal capital affects the returns to moneylending (see Section 4.3 for an extensive discussion of informal interest rates). 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, and this margin cannot be competed away by the bank sector. By contrast, as sufficiently wealthy moneylenders are not tempted by diversion and obtain formal funds at marginal cost they earn no rent in equilibrium, regardless of how they split the surplus with the entrepreneur. In other words, returns to moneylending are higher at lower levels of wealth when the bank sector is competitive.

A related concern is how to interpret scarcity of informal capital in a model with one entrepreneur. One plausible distinction between entrepreneurs and moneylenders is the difference in technology endowments. For example, while farmers' or street vendors' production technology applies to managing their farm or selling fruit at the street stand, traders' or merchants' monitoring technology is applicable to more than one farmer or street vendor. This has several implications. First, it implies that wealth-constrained traders visit formal banks more often than a given farmer and, importantly, has less to gain from diverting bank funds. Consider for instance the modified setting where $\phi_M < \phi_E$: the opportunity cost of being diligent is higher for the entrepreneur. Here banks lend relatively more to moneylenders although entrepreneurs continue to borrow from the formal institution.[31] Second, and related to the first point, while the model solves the case with a wealth-constrained moneylender unable to satisfy the credit needs of one entrepreneur, the natural interpretation is that of a lender rationing a set of clients. This raises the issue of how a capital-scarce moneylender should allocate funds across his borrowers. It also motivates the question of who becomes a moneylender in the first place. I briefly address these issues in the final section of the paper.

3.3. 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. I start by outlining the case without informal lenders and then characterize the outcome under financial sector coexistence.

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 Eq. (3). The participation constraint ensures at least the utility associated with self financing the project. D_E replaces $(1 + r)\, L_E$ with the borrower choosing whether or not to accept the bank's take-it-or-leave-it offer and consequently the amount to invest. It follows that the relevant incentive and/or participation constraint must bind, otherwise the bank could increase D_E and earn a strictly higher profit.

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, whereas D_E is defined as the solution to the incentive constraint. Hence, L_E is the unique loan size that solves

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

while D_E is determined by

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

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). 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. 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.

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

[30] When $\alpha = \hat{\alpha}$, parameter changes also move the threshold barring a comparative static analysis.

[31] Entrepreneurs always have the option of an exclusive bank contract, making it inefficient to exclude them from bank access. If moneylenders were entrepreneurs' only source of funds, entrepreneurs earn (at least) the equivalent of a bank loan but their side payment would not be invested. However, if bank credit is extended to entrepreneurs and moneylenders, the side payment is part of the overall investment.

burden increases both the bank's payoff and the entrepreneur's incentive to default, poor customers earn rent to avoid diversion of bank credit.

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. To illustrate this as simply as possible, attention is restricted to the range of wealth levels where entrepreneurs receive the bank's floor utility, $\omega_E < \omega_E^m$.[32] Remaining cases are briefly discussed in the final section.

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. 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. More precisely

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

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

and

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

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.

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

$$(1-\alpha)[Q(I)-D_M-\omega_E]+\alpha\omega_M=(1-\alpha)[Q(\omega_E+\omega_M)-\omega_E]+\alpha\omega_M, \tag{19}$$

while the equilibrium loan size L_M satisfies

$$(1-\alpha)[Q(\omega_E+\omega_M)-\omega_E]+\alpha\omega_M=\phi(\omega_M+L_M), \tag{20}$$

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) above.

Proposition 4. For all $\alpha > \widetilde{\alpha}$, $\phi > \underline{\phi}$, 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 $\omega_M \geq I^* - \omega_E$.

Proposition 4 is illustrated in Fig. 2. Below $\underline{\omega}_M^m$, the bank lends to both the entrepreneur and the moneylender although at a decreasing rate to the former as the moneylender becomes wealthier. At $\underline{\omega}_M^m$, there is complete segmentation of the formal and informal credit market and the entrepreneur is shut out by the bank (with $L_E = 0$). As the moneylender's wealth increases beyond $\underline{\omega}_M^m$, his incentive constraint gradually becomes more slack and L_M starts to rise. When $\omega_M \geq \overline{\omega}_M^m$, he is able to support the entrepreneur at the first-best level of investment. However, the bank still prefers to lend exclusively to the moneylender although the bank loan starts to decline.

In sum, 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. In poor societies with weak legal institutions, moneylenders' monitoring ability therefore induces two opposing effects. 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.

Note that the constraint on informal lenders' market power is that the entrepreneur's share of the Nash Bargaining exceeds financing the project on her own [$\alpha > \widetilde{\alpha}$ as defined by Eq. (5)]. This is because the monopoly bank prefers lending to both agents at low levels of wealth, barring the option of an exclusive bank contract on part of the entrepreneur or the moneylender.[33] Under segmentation, bank lending is no longer available to the entrepreneur and $\alpha > \widetilde{\alpha}$ ensures that she remains a customer of the moneylender. Also, while the analysis assumes that the formal sector is a monopoly, it is sufficient that the bank has enough market power to make informal lenders' participation constraint bind at some point. Then the bank always finds it more profitable to contract exclusively with the informal sector rather than dealing directly with poor borrowers.

Fig. 3 summarizes Propositions 2 and 4 in terms of the moneylender's debt capacity (assuming a bank-rationed entrepreneur). The competitive benchmark is depicted above the line, with the moneylender's incentive constraint binding below $\underline{\omega}_M^c$. Bank lending to the informal sector continues up to $\overline{\omega}_M^c$, at which point the moneylender self-finances his operations. The imperfectly competitive case is illustrated underneath the line. The incentive constraint binds alone below $\underline{\omega}_M^m$ and together with the participation constraint in-between $\underline{\omega}_M^m$ and $\overline{\omega}_M^m$ The participation constraint determines the outcome in-between $\overline{\omega}_M^m$ and $I^* - \omega_E$. As Fig. 3 illustrates, 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 ($\overline{\omega}_M^c < I^* - \omega_E$). The sections that follow will examine these points in more detail. (The proofs of Proposition 9 and Lemmas A5 and A9 settle the relation between the thresholds.[34])

4. Institutions, market segmentation, and prices

Having established the aggregate demand for and supply of formal and informal credit, I now consider factors that may help explain the prevalence and the persistence of informal finance, as well the variation in informal interest rates.

[32] The threshold ω_E^m is the wealth level at which the entrepreneurs' incentive and participation constraint both bind. It differs from $\underline{\omega}_E^m$, as the investment corresponding to ω_E^m also depends on the moneylender's wealth.

[33] As the bank's incentive rent exceeds the value of the bargaining outcome regardless of how the proceeds are split when the entrepreneur and the moneylender pursue the project without the bank, α only needs to guarantee a utility above what the entrepreneur obtains when self financing her investment.

[34] For low values of ϕ, it is possible that $\overline{\omega}_M^c < \underline{\omega}_M^m$ as $\overline{\omega}_M^c$ ($\underline{\omega}_M^m$) increases (decreases) in ϕ. In what follows, I disregard this possibility.

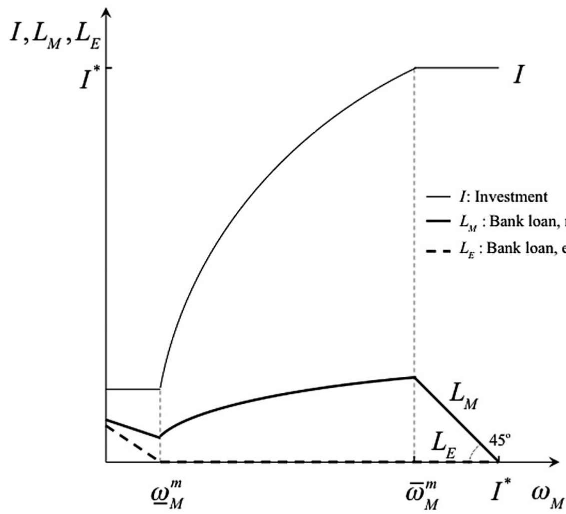

Fig. 2. Uncompetitive bank credit and moneylender wealth.

4.1. Cross-sectional predictions

Empirical evidence shows that the use of informal finance is consistently higher in low-income countries and that bank lending contracts as creditor protection worsens (Chavis et al., 2009; Dabla-Norris and Koeda, 2008). This section explores these questions at some length by studying one of the model's key premises: that informal finance emerges in response to banks' inability to enforce their legal claims. It also investigates the implications of variation in income and in bank market structure. As the competitiveness of the informal sector, α, has an effect on some of my findings, I initially analyze results that are independent of α.

I first show that weaker institutions increase the prevalence of informal credit if borrowers obtain money from both financial sectors, while the opposite is true if moneylenders supply all funds. Specifically, if entrepreneurs and moneylenders obtain bank credit and moneylenders are rich enough not to be tempted by diversion, the ratio of informal credit to investment, $B/I = (\omega_M + \overline{L}_M)/(\omega_E + \overline{L}_E + \omega_M + \overline{L}_M)$, increases in creditor vulnerability ϕ. A hike in ϕ boosts the profitability of nonprudent behavior relative to investment for poor entrepreneurs, inducing a shift to agency-free informal finance (Corollary 1). Consider then 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. That is, 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 (see Section 5 for an extensive discussion).

My theory further predicts that the ratio B/I increases if borrowers are poor and if moneylenders are better capitalized. To see this, note that a rise in entrepreneurial wealth induces a shift from informal to formal finance and a lower B/I if moneylenders are rich enough to attain first best in the competitive benchmark.[35] If the entrepreneur and the moneylender both obtain bank credit under imperfect bank competition, increases in wealth lead to a decrease in credit to limit diversion [below $\underline{\omega}_M^m$ in Fig. 2]. For example, a higher ω_E reduces the moneylender's share of the aggregate loan L_M and B/I drops.[36] By contrast, if the moneylender is the only bank borrower, bank credit increases in ω_M, boosting B relatively more than I as the entrepreneur's wealth is unaffected [see the range between $\underline{\omega}_M^m$ and $\overline{\omega}_M^m$ in Fig. 2].[37]

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 in ϕ 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 $\omega_M < I^* - \omega_E$.

A limitation of Proposition 5 is that it does not apply if entrepreneurs and moneylenders are rationed by competitive banks. This is because variation in ϕ, ω_E, and ω_M affects $\overline{L}_E$ and $\overline{L}_M$ simultaneously, with the impact on B/I depending on how the project gains are shared. This is also true for some of the changes in ω_E under market segmentation.[38] However, by restricting attention to a competitive informal credit market ($\alpha = 1$), the model gives consistent predictions both with respect to institutional quality and with respect to wealth.

Corollary 2. For bank-rationed entrepreneurs, the ratio of competitive informal credit to investment is:

- **(i)** increasing in creditor vulnerability (ϕ) and decreasing in entrepreneurs' wealth (ω_E) if banks are competitive;
- **(ii)** nonincreasing in ω_E if banks have market power and $\omega_M < I^* - \omega_E$.

The results presented in Proposition 5 thus continue to hold in this restricted setting. Interestingly, the first part of Corollary 2 shows that informal finance becomes more important as institutional quality deteriorates even when informal lenders are poor. This is because the reduction in entrepreneurs' bank credit that follows from a higher ϕ dominates the drop in informal lenders' bank credit. To see this, consider the moneylender under bank competition. The decline in $\overline{L}_E$ exceeds the fall in $\overline{L}_M$, since the entrepreneur keeps the full surplus and subsequently holds a larger part of the aggregate bank loan (Corollary 1). (Wealth results follow in similar fashion from Corollary 1.) Under market segmentation, the moneylender's loan and the fraction B/I is independent of entrepreneurial wealth if $\alpha = 1$, as ω_E does not enter Eq. (20).

Using historical data from the United States, Wang (2008) documents how poor farmers primarily relied on wealthy (bank-financed) merchants when the degree of competition in the formal financial sector was low. Propositions 2 and 4 suggest precisely this; that the relative importance of bank-financed moneylenders increases in banks' market power. To show this formally, I first characterize the economy's supply of bank credit. As market structure is irrelevant if moneylenders rely on internal funds, attention is restricted to wealth levels where informal lenders need external capital.

Lemma 1. (i) Entrepreneurs obtain more funds from competitive banks; (ii) There exists a threshold $\hat{\omega}_M(\alpha, \phi) \in (\underline{\omega}_M^c, \overline{\omega}_M^c)$ such that moneylenders with wealth below $\hat{\omega}_M$ obtain more funds from competitive banks and moneylenders with wealth above $\hat{\omega}_M$ obtain more funds under imperfect bank competition.

Since all benefits accrue to the entrepreneurs under competitive banking, banks supply more credit as a result of improved incentives.

[35] That is, $\overline{L}_E$ (L_M) increases (decreases) following a boost in ω_E (Corollary 1). Higher moneylender wealth does not affect B/I though, as hikes in ω_M are compensated by decreases in L_M.

[36] As investment is locked at the suboptimal level [given by Eq. (18)], an increase in ω_E only improves the entrepreneur's bargaining position, forcing the bank to lower L_M.

[37] At first best, the outcome is analogous to the competitive case described in footnote 35.

[38] The effect of ϕ on B/I is ambiguous below $\underline{\omega}_M^m$ (when entrepreneurs and moneylenders access the bank under imperfect bank competition), as a higher ϕ leads to less bank lending *and* a lower suboptimal investment [given by (18)]. The total effect depends on which reduction is larger (independently of how project proceeds are split).

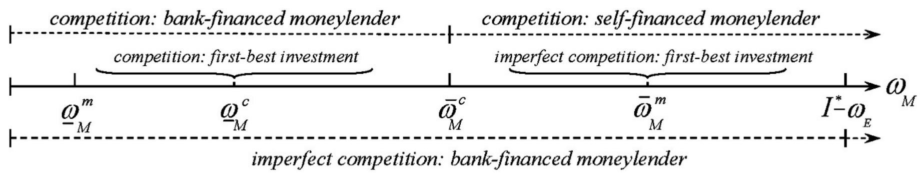

Fig. 3. Moneylender wealth thresholds across the banking regimes.

Figs. 1–3 show that moneylenders take more competitive bank credit up to first best ($\underline{\omega}_M^c$), then reduce their loan in step with rising wealth. Meanwhile, the imperfectly competitive bank continues to extend additional funds as the efficient outcome ($\overline{\omega}_M^m$) remains to be attained.

Proposition 6. The ratio of informal credit to investment is higher when banks have market power and $\omega_M \in (\hat{\omega}_M, I^* - \omega_E)$ and indeterminate with respect to bank market structure for wealth below $\hat{\omega}_M$.

While entrepreneurs obtain more funds from poor moneylenders if banks compete, they also take additional bank credit (Lemma 1), making the exact prediction imprecise. However, as moneylenders become wealthier the outcome is clear: informal finance should be more important if it allows banks to save the agency costs.

4.2. Welfare, segmentation, and financial development

Why does financial sector underdevelopment, in the form of market segmentation, persist? One reason is that those who potentially influence the levers of power (for example, wealthy informal lenders and influential bankers) gain from status quo. As discussed in more detail below, bank markets in the early twentieth century United States were more concentrated in counties with wealthy landowners, who often engaged in lending to local farmers (Rajan and Ramcharan, 2011). I investigate this issue here by considering how welfare is distributed in the economy.

Proposition 7. (i) Entrepreneurs and poor moneylenders, $\omega_M < \underline{\omega}_M^c$, are better off when banks are competitive, whereas banks and sufficiently wealthy moneylenders, $\omega_M > \underline{\omega}_M^c$, are better off when banks have market power; (ii) Entrepreneurs prefer a bank with market power over the coexistence of a moneylender and a bank with market power.

Informal finance supports entrepreneurs' asset growth in the competitive setting. The reason is twofold. Competition transfers the entire surplus to the bank borrowers, allowing more credit to be extended. Moneylenders reinforce this effect by further expanding credit provision and by softening the entrepreneurs' incentive problem. Competition also adds value to poor moneylenders as they receive more bank funds. By contrast, banks and wealthier moneylenders are better off if financial markets are segmented. This is because the segmented outcome preserves the market power that moneylenders' enforcement advantage grants them (α remains unchanged), whereas they are forced to give up all their rent under competitive banking ($\alpha = 1$). Part (ii) of Proposition 7 makes borrowers' welfare loss explicit. Poor entrepreneurs receive less funds and consequently lower floor utility from the monopoly bank (for a given investment) if it also extends credit to the moneylender. If moneylenders provide all external capital, entrepreneurs earn the equivalent of doing the project alone with the informal lender, worth strictly less than the incentive rent provided by the bank.

In sum, besides allowing banks to reduce agency cost, credit market segmentation also softens competition between the formal and the informal financial sector, providing an additional rationale for its persistence.

4.3. Informal interest rates

Aleem (1990), Banerjee (2003), and others have shown that poor borrowers with similar characteristics face informal interest rates ranging from 0 to 200% annually in India, Pakistan, and Thailand.[39] In fact, there is large variation in informal lending rates even within the same sub economy. I now examine factors that rationalize some of the observed heterogeneity.

Proposition 8. (i) Bank-rationed moneylenders charge positive rates of interest, $R/B - 1 > 0$; (ii) $R/B - 1 > 0$ is higher when moneylenders are sufficiently wealthy, $\omega_M > \underline{\omega}_M^c$, and banks have market power.

First, poor moneylenders charge positive rates of interest regardless of the degree of competition in the adjacent bank market. This is because the price of informal credit reflects the incentive rent moneylenders receive to ensure prudent behavior when forwarding bank funds. Competition from the bank sector is thus softened as excessive lending to poor entrepreneurs and/or poor moneylenders would result in diversion. By contrast, a self-financed informal sector offers credit at the opportunity cost of funds.

Second, as moneylender wealth climbs, informal lenders make no profit in the competitive setting ($\alpha = 1$). Meanwhile, the segmented outcome preserves moneylenders' bargaining position [$\tilde{\alpha} \in (0, 1)$] resulting in strictly positive interest rates. In fact, as long as informal lenders finance their operations using formal bank credit, $\omega_M < I^* - \omega_E$, their enforcement advantage grants them rent under imperfect bank competition.

The impact of scarce informal capital on informal interest rates thus depends on the interaction between creditor vulnerability and the competitiveness of the banking market, with terms offered to the same borrower ranging from an effective price of zero to very high rates. Accounting for informal lenders' financing capacity and the possibility of market segmentation complements the emphasis on monitoring cost as an explanation for the observed steep lending rates (see Banerjee, 2003).[40]

5. Empirical evidence

The analysis in Section 3 (Propositions 2 and 4) highlights the interaction between weak institutions, poor agents, and inefficient markets. As briefly reviewed in the introduction, there is ample evidence showing that better legal protection alleviates credit rationing, that informal lenders turn to the formal financial sector for additional funds, and that market power is a recurring phenomenon in developing credit markets. Combining these facts, the model concludes that all but the wealthiest borrowers turn either to both financial sectors simultaneously or to the informal sector exclusively.

The finding that borrowers' formal sector debt capacity increases in their wealth is consistent with a series of empirical studies on formal–

[39] For additional evidence, see Udry (1990, 1994) and La Ferrara (2003) for the case of Africa and Das-Gupta et al. (1989) and Siamwalla et al. (1990) for the case of Asia.

[40] The zero interest result partly depends on the assumption of zero monitoring cost. However, while allowing for positive monitoring cost on part of the moneylender adds another layer, it does not qualitatively alter the findings.

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). For example, in 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.

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.[41] In these instances, informal lenders' capital base not only raises investment but also enables borrowers to draw on additional formal finance. In their account of contract farming in North America, Latin America, and Africa, Glover and Kusterer (1990) write that the informal funding provided by traders and input suppliers "serves to assure banks of the farmer's credit-worthiness, thus facilitating access to private [bank] credit" (Glover and Kusterer, 1990, p. 130).[42] Related evidence is provided by Campion (2006) in her study of Peru's artichoke sector. Campion documents that 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) description of soybean farmers in Paraguay tells a similar story. Farmers 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.[43]

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 their study of 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" (Floro and Yotopoulos, 1991, p. 46). Similarly, 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. Those that take formal credit (and on lend) are "people with sufficient collateral and credibility to borrow from formal sector financial institutions" (Rahman, 1992, p. 154). Related support is provided by 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).[44]

In the model, the degree of bank competition affects formal financial sector access as well as the role of informal lenders. This is in line with historical evidence from Plymouth County in New England, United States (Wang, 2008). Using detailed bank, census, and court records between 1803 and 1850, Wang documents how increased bank competition allowed poor farmers and artisans to partially substitute from informal finance provided by wealthier (bank-financed) merchants, to formal bank credit. Bank records show that merchants, esquires, and gentlemen (the rich) accounted for most of the transactions when the county comprised one bank.[45] 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.[46] Contemporary data echo these findings. In 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. Also, 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.[47, 48]

My model also 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 and Corollary 2. They show that the relationship between legal institutions and informal credit is indeterminate, while bank lending contracts as creditor protection worsens. More systematic evidence is offered in a recent study by Chavis et al. (2009) covering 70,000 small and medium-sized firms in over 100 countries. As implied by the model, improvements in creditor protection have a positive effect on access to bank finance, particularly for young (and small) firms.[49] Specifically, the interaction between rule of law and firm age is significant and negative for bank finance. Meanwhile, there is no significant interactive effect of rule of law for finance coming from informal sources and trade credit. My theory explains the insignificant effect by showing that the relationship can go either way, while bank credit—if accessible—increases in creditor protection. 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.

Proposition 7 shows that wealthier informal lenders (and banks) prefer the segmented outcome that arises with bank market power, as it softens competition between the financial sectors. This

[41] See Reardon and Timmer (2007) for the importance of credit provision in the agricultural output market.

[42] See also Watts (1994) for related support.

[43] For a similar account from Croatia, see Matić et al. (2006).

[44] See Biggs (1991) for related evidence from early twentieth century Taiwan, where larger firms on-lent commercial bank credit directly to smaller downstream customers lacking bank access.

[45] Esquires and gentlemen were honorary titles given to people with more wealth and higher social status. Esquires could be merchants, large land-owning farmers, attorneys, and judges. Gentlemen were another economically better-off class, if not quite as wealthy as esquires.

[46] That is, the cases where farmers appeared as defendants and merchants as plaintiffs declined after the entry.

[47] Note that 30% of the households in 1991 still held loans from the government, traders, and landlords.

[48] Findings from China also show that informal finance is more prevalent in the central and the northwest regions where bank competition is scant and less important in the coastal region where banks are more competitive (Ayyagari et al., 2010; Cheng and Degryse, 2010; Cull and Xu, 2005).

[49] A drawback of these findings is their focus on firm age rather than firm size/collateral. Other variables, such as reputation, may have an independent effect on credit access besides collateral. However, to the extent that young firms still have lower wealth, the empirical evidence does corroborate the model's conclusions.

resonates with the work of Rajan and Zingales (2003) on incumbent financial institutions' historical support for financial repression to maintain status quo. In particular, suppose rich moneylenders and bankers have more say over local bank market structure than poor entrepreneurs, for example, through branching restrictions on banking. In this case, Proposition 7 provides a political-economy explanation as to why informal finance and bank market power are pervasive features of less developed credit markets. In line with my theory, Rajan and Ramcharan (2011) find that bank markets in the early twentieth century United States were more concentrated in counties with wealthy landowners, who often engaged in lending to local farmers. These landlords frequently had ties with the local bank and the local store (that offered credit) and were, as the model predicts, against bank deregulation.[50] Rajan and Ramcharan show that there were fewer banks per capita and less formal bank lending to poor farmers (as well as higher formal interest rates) in counties with a more unequal distribution of farm land. This is consistent with the skewed distribution of wealth needed to support the theory's predictions. In the model, relatively better-off informal lenders are more creditworthy compared to poor entrepreneurs.

6. Economic policy

Before I consider possible reforms, let me summarize the main results so far.[51] The model's basic distortion is the inability of formal banks to enforce their contracts. Better functioning institutions not only allow banks to lend more to poor borrowers and poor informal lenders, they can also reduce informal interest rates.[52] If the aim is to replace informal with formal finance, wealth subsidies may be more effective policy however. While the prevalence of informal finance decreases in entrepreneurial wealth, informal credit becomes more important as legal protection of banks improves if credit markets are segmented.

Propositions 2 and 4 show that financial sector coexistence increases efficiency compared to a pure bank lending regime. The policy recommendations that follow are straightforward from an efficiency perspective, but less clear in terms of borrower welfare. Although regulation fostering informal sector growth is beneficial for poor borrowers in the competitive benchmark, the opposite is true under credit market segmentation (Proposition 7). Moreover, while pro-competitive bank reforms raise efficiency,[53] help borrowers access the formal sector, and reduce informal interest rates, the caveat may be the lack of political will to introduce such policies, as discussed in Section 4.2. Hence, programs that strengthen borrowers' outside options (similar to the empowerment strategies of poor tenants documented in Banerjee et al., 2002) offer a way to diminish the reliance on credit provided by informal lenders and banks. Specifically, it points to the importance of alternative sources of credit, such as microfinance. In fact, microfinance programs may present a more viable alternative if powerful vested interests (in the form of wealthy informal lenders and banks) are opposed to bank market reforms.

I now analyze the effects of subsidized credit by allowing for a positive cost of bank capital, ρ. Introducing ρ has three effects: it offers a deposit return that enters the outside option in the bargaining, it affects the residual return for a given loan size, and it alters the sub-optimal investment if banks have market power. While a lower ρ increases investment if the moneylender and the entrepreneur obtain bank credit—regardless of bank market structure—it *decreases* lending to the bank-rationed moneylender and subsequent investment under market segmentation. This is because a drop in ρ weakens the moneylender's outside option in his bargaining with the entrepreneur, while the bank's price is unaffected [as $D_M > (1+\rho)L_M$]. The end effect is a decrease in the prevalence of informal finance and lower efficiency.

Proposition 9. (i) Financial sector coexistence and bank market competition increase investment (I); (ii) I decreases in the opportunity cost of capital (ρ), except if moneylenders are bank rationed under credit market segmentation, then I increases in ρ.

Which reform is most efficient? In what follows, I explore the differential impact of changes in creditor protection, cost of capital, and wealth in terms of gross benefits. Under bank competition, reduced creditor vulnerability boosts investment more than a lower cost of capital. The reason is that ϕ influences the marginal return to the entire investment, whereas ρ only affects the return to the bank loan. Specifically, a drop in ϕ decreases both the opportunity cost of being diligent with bank credit ($\bar{L}_E + \bar{L}_M$) and with internal funds ($\omega_E + \omega_M$), while a reduction in ρ increases the residual return for a given loan ($\bar{L}_E + \bar{L}_M$). In the imperfectly competitive scenario, two cases need to be considered. When the entrepreneur and the moneylender borrow from the bank, changes in creditor vulnerability and cost of capital have an analogous impact on the sub-optimal investment given by Eq. (18).[54] Under market segmentation, a lower ϕ increases investment (Proposition 5), while a reduction in ρ decreases it (Proposition 9).[55]

Wealth subsidies to borrowers follow the standard prescription in credit-rationing models, where redistribution in favor of poor entrepreneurs supports increased borrowing and investment. In my model, informal lenders also face binding credit constraints, suggesting that these policy implications need to be modified. Consider a reform that redistributes one dollar from the entrepreneur to the moneylender. If rationed entrepreneurs and moneylenders access the bank, the transfer affects the bargaining weights and subsequent bank lending, but not the project's size since every dollar is invested. Under market segmentation, a reallocation in favor of the bank-rationed moneylender *increases* investment. As the moneylender's share of the investment outcome, not the overall size, determines the incentive-compatible bank loan [Eq. (20)], an additional dollar of moneylender wealth draws more bank money into the project. A similar result is obtained in the competitive benchmark if entrepreneurs' opportunity cost of being diligent exceeds moneylenders' cost, $\phi_M < \phi_E$. Although every dollar is invested, moneylenders attract more bank credit since they are less likely to divert the funds. In sum, while grants to poor entrepreneurs increase investment and decrease the prevalence of informal finance, transfers to the informal sector may be a more efficient policy choice.

Proposition 10. Investment (I) increases weakly if:

- **(i)** creditor vulnerability (ϕ) decreases rather than the opportunity cost of capital (ρ) and $I < I^*$;
- **(ii)** wealth is redistributed from entrepreneurs to moneylenders.

[50] In his study of farm credit in Texas, Haney (1914) writes that the "country merchant act as the banker's agent in making crop mortgage loan" (Haney, 1914, p. 54). Haney estimates that as much as 20% of all loans in Texas banks were made to country merchants for the purpose of funding crop mortgage securities.

[51] In what follows, I examine policies that are productivity enhancing, that is, they raise investment. This does not imply Pareto efficiency however; see Bardhan et al. (2000) for a discussion.

[52] The interaction between creditor vulnerability and the credit market endogenously determines the threshold of wealth necessary to attain an efficient investment using only bank funds. Hence, stronger creditor protection also implies that entrepreneurs with less wealth will succeed in securing an exclusive bank contract.

[53] In the proof of Proposition 9, I show that $\overline{\omega}_M^m > \overline{\omega}_M^c$. That is, a moneylender stops borrowing from competitive banks before first best is attained in the imperfectly competitive case. [See Fig. (3).]

[54] More specifically, the modified equation reads $Q'(I) - (1+\phi+\rho) = 0$.

[55] At first best, variation in ϕ has no effect on investment while a reduction in ρ increases investment by changing the optimal project size, determined by $Q'(I) - (1+\rho) = 0$.

Redistribution raises investment partly because of moneylenders' perfect monitoring ability. If entrepreneurs invest a fraction of the informal loan, the statement remains correct under credit market segmentation, while the policy lowers efficiency in the competitive benchmark. Inefficient monitoring matters less under segmentation as the transfer's main effect in this case comes through a shift in the relative bargaining weights.[56]

7. Discussion and concluding remarks

A worthwhile question is why the bank does not merge with the moneylender, making him the local branch manager? Specifically, the bank supplies the financial resources and the moneylender the local knowledge. In the current setting, internal funds are a necessary condition however. Incentive compatibility is violated if banks extend credit to penniless informal lenders/bank employees. Consider the competitive benchmark with a competitive informal sector. In this case, moneylenders' incentive constraint collapses to $R-\bar{L}_M=\bar{L}_M-\bar{L}_M=0<\phi\bar{L}_M$. But it is also true when moneylenders hold all the bargaining power.[57] Two important observations follow. First, it is not sufficient to have a superior enforcement technology to on lend bank funds. Second, informal lenders are not bank agents; they need to put their own money at stake to facilitate the intermediation of formal credit. In sum, "bringing the market inside the firm" at best replicates the market outcome, as the branch manager has to be incentivized to act responsibly with the bank funds. However, the merger also adds a new dimension, the employer–employee relationship, which opens up for opportunistic behavior on the part of the bank as well.[58] Hence, the overall effect is likely to be efficiency reducing, confirming why this kind of organizational design is uncommon in developing credit markets.

A related concern is whether the key insights would be altered if informal monitoring was less efficient, if other sharing rules governed the moneylender's and the entrepreneur's exchange, or if agents engaged in side payments? As regards the first objection, suppose the entrepreneur fails to invest a fraction $\delta\in(0,1)$ of the moneylender's funds.[59] It can be shown that for δ sufficiently small, equilibrium outcomes remain the same. Pertaining to the choice of sharing rule, the Nash Bargaining solution produces an efficient outcome similar to Coasian bargaining since utility is transferable. Any sharing rule therefore yields quantitatively similar results in terms of the ensuing investment. Finally, side payments do not change the equilibrium outcomes since poor entrepreneurs and/or poor moneylenders are unable to compensate the other party and/or the bank due to their wealth constraints. That is, available funds are always used most efficiently in production. To see this, take the case of competitive banking. Note first that the option of investing and lending is individually and jointly incentive compatible for wealth-constrained entrepreneurs and moneylenders [the former is given by Eqs. (9) and (10) and the latter by the maximum-incentive compatible investment level, $Q(I)-I+\omega_E+\omega_M=\phi(I)$, derived from Eqs. (9) and (10)]. Suppose then that the entrepreneur still is constrained while the moneylender is sufficiently wealthy such that first best is attained. Here the best option for the entrepreneur is to use his wealth within the project and boost the credit line (and corresponding investment).

Allowing for rising entrepreneurial wealth in the imperfectly competitive case changes little if the entrepreneur's wealth climbs and wealth disparity is maintained. Here the bank is indifferent between dealing with the (relatively) richer moneylender alone and lending a small amount to the entrepreneur and the remainder to the moneylender. If the entrepreneur is the richer party, the outcome resembles the one analyzed in detail above, now with the bank gradually reducing its loan to the poor moneylender. If entrepreneurs and moneylenders are equally affluent though short of first best, both receive credit. Finally, similar to bank competition, rich entrepreneurs only take bank credit. Thus what matters for the results is that informal lenders hold relatively more assets compared to entrepreneurs.

An alternative interpretation of my model complements theoretical work on group lending. In this modified setting, the bank lends to multiple entrepreneurs who work on a joint project. This extension follows naturally given the assumption that the moneylender and the entrepreneur have the same ϕ. Similar to theories of joint-liability lending, the entrepreneur and the moneylender have a mutual interest in enforcing their contract with respect to the shared project, with the important difference that they are individually liable versus the bank.[60]

In addition, as the model stands, informal lenders' occupational choice is restricted to lending. The setup has allowed me to analyze how the basic traits uniting informal lenders: local enforcement and some wealth, shape less developed credit markets. In a more general setting, additional sources of income (and/or collateral) make it less tempting to behave non-diligently, enabling the bank to supply more funds or save on incentive-related costs. Extending the theory by admitting complementary sources of income would permit for a characterization of how informal lenders' enforcement technology and debt capacity vary across occupation and how monitoring ability and wealth interact in attracting outside funding. For example, are input suppliers better suited to extend credit to poor farmers and draw on external capital, as compared to landlords, merchants, shopkeepers, and upstream buyers? Another issue worthwhile to investigate, is how a capital-constrained moneylender allocates his funds across multiple borrowers? A conjecture is that the informal lender equalizes the returns across his clients i, j such that $R'(B_i)=R'(B_j)$, for $i\neq j$. As repayment is a function of the amount invested, B will be set to equalize investment across the borrowers. A constrained lender would, however, be forced to ration those with low project returns. The fact that informal capital may be scarce also raises the question of who becomes a moneylender. Such a model has the potential to explain, among other things, how the informal sector's market power is determined. If enforcement rests on social sanctions available within a community but all members are equally poor, anyone can become a moneylender, as well as attract outside funding. By contrast, if one villager is slightly wealthier than the rest, she will attract all outside funding and become the local monopolist. Another topic for future research would be to develop a more explicit political-economy model to understand the interaction between the credit market and the formation of interest groups.

In closing, the theory laid out in this paper lends itself to empirical testing. While the key findings stand up well to the available evidence, more quantitative work is needed to thoroughly understand how the informal sector's resource constraints affect its ability to finance poor borrowers as well as attract outside funding. Combining systematic data on informal lenders' debt capacity with measures of institutional quality and market structure would also allow for further tests of the model's predictions. Detailed micro evidence that sheds light on the role played by informal finance would be an important complement to the growing experimental literature investigating microfinance in developing countries.

[56] If the diversion return is higher for the entrepreneurs, $\phi_M<\phi_E$, Proposition 10 is still valid even with imperfect informal monitoring, given that the monitoring technology is efficient enough and/or the difference $\phi_E-\phi_M$ is sufficiently large.

[57] First, note that the project's aggregate incentive-compatible bank loan is the same, with or without the penniless moneylender, as he does not add to investment. Second, when $\alpha=\hat{\alpha}$, the entrepreneur receives her outside option, equivalent of exclusive bank borrowing, but this is exactly the value of the entire project including the moneylender. Hence, after compensating the entrepreneur, the moneylender earns zero. When bank competition is imperfect, a loan to a penniless moneylender satisfies incentive compatibility. However, entrepreneurs prefer an exclusive bank contract as it increases their incentive rent. Since the bank is indifferent between lending to entrepreneurs alone or both (aggregate rent and loan size remain the same) and entrepreneurs are the project's proprietors, moneylenders get shut out.

[58] Similar in spirit to Williamson's (1985) arguments of why "selective interventions" are hard to implement.

[59] The value δ could be a deadweight loss or, alternatively, a benefit accruing directly to the entrepreneur.

[60] I thank a referee for this point.

Appendix A

The following result will be helpful in the subsequent analysis.

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,

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

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. □

A.1. Proof of Proposition 1

Proposition 1 is proved in the main text, except for the comparative static results and the existence and the uniqueness of ω_E^c.

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

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

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)]. □

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. □

A.2. Proof of Proposition 2

I show the existence and the uniqueness of ω_E^c, $\underline{\omega}_M^c$, $\overline{\omega}_M^c$, and $\hat{\alpha}$ and proceed with the equilibrium outcomes.

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

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

and

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

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

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

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 $Q'(I)\geq 1$. □

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 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. □

A.3. Proof of Corollary 1 (comparative statics)

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. □

A.4. Proof of Proposition 3

Proposition 3 is proved in the main text, except for the comparative static results and the existence and the uniqueness of $\underline{\omega}_E^m$ and $\overline{\omega}_E^m$.

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

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

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 $Q\left(\overline{\omega}_E^m\right)I'=Q\left(\underline{\omega}_E^m\right)I^*$, 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 $Q(I^*)-I^*=Q\left(\overline{\omega}_E^m\right)-\omega_E^c$, where $\overline{\omega}_E^m>\omega_E^c$ follows from concavity. □

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

Proof. When $\omega_E\leq\underline{\omega}_E^m$, 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 $\omega_E\in\left(\underline{\omega}_E^m,\overline{\omega}_E^m\right)$, 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 $Q'(I)\geq 1$ and $\phi<1$. □

A.5. Proof of Proposition 4

I show the existence and the uniqueness of ω_E^m, $\underline{\omega}_M^m$, $\overline{\omega}_M^m$, and $\tilde{\alpha}$ and proceed with the equilibrium outcomes.

Lemma A9. There exist unique thresholds $\omega_E^m(\alpha,\phi)>0$, $\underline{\omega}_M^m(\alpha,\phi)$, $\overline{\omega}_M^m(\alpha,\phi)$, and $\tilde{\alpha}$ 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) $\tilde{\alpha}\in(0,1)$.

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

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

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, $\omega_E^m>0$.

Part (ii): The threshold $\underline{\omega}_M^m$ is the smallest wealth level at which M's incentive constraint equals his participation constraint allowing an investment of $\omega_E+\omega_M+L_M=I$, 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 $dL_E/d\omega_M+dL_M/d\omega_M=-1$.

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

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

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 $\left(I'-\omega_E\right)\{(1-\alpha)\times[Q(\omega_E+\overline{\omega}_M^m)-\omega_E]+\alpha\overline{\omega}_M^m\}=(I^*-\omega_E)\{(1-\alpha)[Q(\omega_E+\underline{\omega}_M^m)-\omega_E]+\alpha\underline{\omega}_M^m\}$, with I' given by Eq. (18) in the main text, and hence $\overline{\omega}_M^m>\underline{\omega}_M^m$. Finally, $\underline{\omega}_M^m>0$ follows from the assumption that $\phi>\underline{\phi}$.

Part (v): The proof is provided in the main text. □

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

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 $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$ 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. □

A.6. 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. □

A.7. Proof of Corollary 2

Proof. Part (i): When $\omega_E < \omega_E^c$, $\omega_M < \underline{\omega}_M^c$, and $\alpha = 1$ the relevant constraints are given by Eqs. (9) and (10) in the main text. Differentiating Eqs. (9) and (10) with respect to I, ω_E, and ϕ using Cramer's rule I obtain $dI/d\phi = -\phi I/\Theta$ and $dI/d\omega_E = \phi/\Theta$, with $\Theta = \phi[1 + \phi - Q'(I))] > 0$, where the inequality follows from Lemma A2. Using Corollary 1 and the derived comparative statics, I have that $r_\phi = \{[B(Q'(I) - (1+\phi))]I + B\phi I\}/\Theta I^2 = B[Q'(I) - 1]/\Theta I > 0$ and $r_{\omega_E} = -\phi B/\Theta I^2 < 0$, where the inequalities follow from $Q'(I) \geq 1$. When $\omega_E < \omega_E^c$ and $\omega_M \geq \underline{\omega}_M^c$, the results are found in the proof of Proposition 5, Part (i).

Part (ii): When $\omega_E < \omega_E^m$, $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$, and $\alpha = 1$, the relevant constraints are given by Eqs. (19) and (20) in the main text. Differentiating Eqs. (9) and (10) with respect to I, L_M, and ω_E using Cramer's rule I obtain $dI/d\omega_E = 1$ and $dL_M/d\omega_E = 0$. Using the derived comparative statics I have that $r_{\omega_E} = -B < 0$. When $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$ or $\omega_M \geq \overline{\omega}_M^m$, the results are found in the proof of Proposition 5, Part (ii). □

Proof of Lemma 1. [As above, the competitive (monopoly) outcome is denoted by superscript c (m).]

Proof. Part (i): There are two distinct cases to consider. First, when $\omega_M < \underline{\omega}_M^m$, $I^c > I^m$ follows from Lemma A2, Eq. (18) in the main text, and concavity. Combining Eqs. (9) and (10) and Eqs. (16) and (17) in the main text, yields $Q(I^c) - I^c = \phi I^c$ and $Q(I^m) - D = \phi I^m$, respectively. Subtracting L_E^m from L_E^c using E's incentive constraints given by Eqs. (9) and (16) yields $\alpha[Q(I^c) - I^c - (Q(I^m) - D)] = \alpha(I^c - I^m) > 0$ and hence $L_E^c > L_E^m$. Next, when $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$, monopoly bank lending to E ceases, hence $L_E^c > L_E^m = 0$.

Part (ii): I begin by showing the existence and the uniqueness of $\hat{\omega}_M$. From Lemma A5 $dL_M^c/d\omega_M > 0$ when $\omega_M \in (\underline{\omega}_M^c, \overline{\omega}_M^c)$. In addition, from Lemma A9, $dL_M^m/d\omega_M > 0$ when $\omega_M \in (\underline{\omega}_M^m, \overline{\omega}_M^m)$. By continuity and Proposition 9, there exists a unique threshold $\omega_M = \hat{\omega}_M(\alpha, \phi)$ for $\omega_M \in (\underline{\omega}_M^c, \overline{\omega}_M^c)$ at which $L_M^c = L_M^m$. Having established the existence and the uniqueness of $\hat{\omega}_M$, there are four distinct cases to consider. First, when $\omega_M < \underline{\omega}_M^m$, the proof is analogous to the proof of Part (i) resulting in $L_M^c > L_M^m$. Second, suppose $L_M^m > L_M^c$ when $\omega_M \in [\underline{\omega}_M^m, \hat{\omega}_M)$. This implies that $\overline{\omega}_M^m < \underline{\omega}_M^c$, which contradicts Proposition 9 and so $L_M^c > L_M^m$. Third, when $\omega_M \in [\hat{\omega}_M, \overline{\omega}_M^c)$ I have from Lemma A10 that $L_M^m > L_M^c = 0$. Fourth, when $\omega_M \in [\overline{\omega}_M^c, I^* - \omega_E)$, competitive bank lending to M ceases, hence $L_M^m > L_M^c = 0$. □

A.8. Proof of Proposition 6

Proof. When $\omega_M \in (\hat{\omega}_M, I^* - \omega_E)$, $B^m/I^m - B^c/I^c = (B^m I^c - B^c I^m)/I^m I^c > 0$, since $B^m > B^c$ from Lemma 1 and $I^c \geq I^m$. When $\omega_M < \hat{\omega}_M$, $B^m/I^m - B^c/I^c$ is indeterminate, as $B^m < B^c$ from Lemma 1, while $I^c > I^m$. □

Proof of Proposition 7. (Let U_E^i and U_M^i denote E's and M's respective utility.)

Proof. Part (i): First, from Lemma 1 I have that $L_E^c > L_E^m$. Hence, for $\omega_M < \underline{\omega}_M^m$, $U_E^c = \phi(\omega_E + L_E^c) > \phi(\omega_E + L_E^m) = U_E^m$ and for $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$, $U_E^c = \phi(\omega_E + L_E^c) > \phi(\omega_E + L_E^m) > \alpha Q(\omega_E + \omega_M) + (1-\alpha)\omega_E + \alpha\omega_M = U_E^m$. Next, when $\omega_M < \underline{\omega}_M^c$, $U_M^c = \phi(\omega_M + L_M^c) > \phi(\omega_M + L_M^m) = U_M^m$. When $\omega_M \in [\underline{\omega}_M^c, I^* - \omega_E)$, $U_M^c = \omega_M < (1-\alpha) \times [Q(\omega_E + \omega_M) - \omega_E] + \alpha\omega_M = U_M^m$.

Part (ii): Denote isolation by U_E^{mi} and coexistence by U_E^{mc}. For $\omega_M < \underline{\omega}_M^m$, $U_E^{mi} = \phi I' > \phi(I' - \omega_M - L_M) = U_E^{mc}$ [with I' given by Eq. (18) in the main text] and for $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$, $U_E^{mi} = \phi I' > \phi(I^* - \omega_M - L_M) > \alpha Q(\omega_E + \omega_M) + (1-\alpha)\omega_E - \alpha\omega_M = U_E^{mc}$. □

A.9. Proof of Proposition 8

Proof. Part (i): In the competitive benchmark when $\omega_E < \omega_E^c$ and $\omega_M < \underline{\omega}_M^c$, I have that $R^c/B^c - 1 = [\phi(\omega_M + L_M) - \omega_M]/(\omega_M + L_M) > 0$ using Eq. (10) in the main text, where the inequality follows from $\omega_M < \underline{\omega}_M^c$. In the monopoly case when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$, $R^m/B^m - 1 = \{(1-\alpha)[Q(I) - D - \omega_E - \omega_M] + D_M - L_M\}/B^m > 0$, where the inequality follows from $(1-\alpha)[Q(I) - D - \omega_E - \omega_M] = \phi(\omega_M + L_M) - \omega_M > 0$ [using Eq. (17) in the main text] while $D_M - L_M \geq 0$. When $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, I^* - \omega_E)$, $R^m/B^m - 1 =$

$\{(\omega_E + \omega_M + L_M) - \omega_E - \omega_M - L_M - \alpha[Q(\omega_E + \omega_M)] - \omega_E - \omega_M\}/B^m$ using Eq. (19) in the main text to solve for D_M. As the numerator decreases in α, it suffices to show that the numerator is positive for $\alpha = 1$. Setting $\alpha = 1$ and applying the mean-value theorem yields $Q(\omega_E + \omega_M + L_M) - Q(\omega_E + \omega_M) - L_M = L_M[Q'(\xi) - 1] > 0$, where the inequality follows from $Q'(I) \geq 1$ and concavity with $Q'(\xi) \in (Q'(\omega_E + \omega_M + L_M), Q'(\omega_E + \omega_M))$.

Part (ii): When $\omega_E < \omega_E^c$ and $\omega_M \in [\underline{\omega}_M^c, I^* = -\omega_E)$ under competitive banking, $R^c/B^c - 1 = 0$ as $\alpha = 1$. From part (i) above and since $\underline{\omega}_M^c < \overline{\omega}_M^m$ [showed in the proofs of Lemmas A5 and A9 and Proposition 9, part (i)], I obtain that $R^m/B^m - 1 > R^c/B^c - 1$ for $\omega_M \in [\underline{\omega}_M^c, I^* - \omega_E)$. □

A.10. Proof of Proposition 9

Proof. Part (i): I start with financial sector coexistence. Under competitive banking, the relevant constraints are given by Eqs. (A2) and (A3). Denote the critical ω_E that satisfies Eq. (A3) by $\hat{\omega}_E^c$. Comparison yields $\omega_E^c > \hat{\omega}_E^c > 0$, where the last inequality follows from the assumption that $\phi > \phi$. Under monopoly banking, two investment levels I' [given by Eq. (18) in the main text] and I^* need to be verified. Starting with I' and combining Eqs. (A6) and (A7), yields $Q(\underline{\omega}_E^m) = \alpha Q(\omega_E^m + B) + (1-\alpha)\omega_E^m - \alpha B + \phi B$. As the critical threshold ω_E^m decreases in α, it follows from concavity that $\underline{\omega}_E^m > \omega_E^m$. The proof when $I = I^*$ is analogous and omitted. Next, I turn to bank market power. First, note that $\overline{\omega}_M^m$ as defined by Eq. (A9) decreases in ω_E. In particular, allow ω_E to increase up to the point at which $\phi(\omega_E + L_E) - \alpha Q(\omega_E + \omega_M) - (1 - \alpha)\omega_E + \alpha\omega_M = 0$ for $\omega_E + L_E + \omega_M = I^*$, or $\phi(I^* - \omega_M) - \alpha Q(\omega_E + \omega_M) - (1 - \alpha)\omega_E + \alpha\omega_M = 0$. Denote the critical ω_M that satisfies this last equality by $\widetilde{\omega}_M^m$. From the previous argument it follows that $\widetilde{\omega}_M^m < \overline{\omega}_M^m$. Hence, to show that $\overline{\omega}_M^c < \overline{\omega}_M^m$, it suffices to verify that $\widetilde{\omega}_M^c < \overline{\omega}_M^m$. Then, observe that $\widetilde{\omega}_M^m$ decreases in α. Hence, combining the expression for $\widetilde{\omega}_M^m$ as defined above with the expression for $\overline{\omega}_M^c$ as given by Eq. (A4) and allowing $\alpha = 1$, yields $I^*[Q(I^*) - \quad I^* - Q\left(\omega_E + \widetilde{\omega}_M^m\right) + \omega_E + \widetilde{\omega}_M^m] + \overline{\omega}_M^c\left[Q\left(\omega_E + \widetilde{\omega}_M^m\right) - \widetilde{\omega}_M^m\right] - \widetilde{\omega}_M^m[Q(I^*) - I^* + \omega_E] = 0$. Let $Q(I^*) - I^* - Q\left(\omega_E + \widetilde{\omega}_M^m\right) + \omega_E + \widetilde{\omega}_M^m \equiv \Phi$, where $\Phi > 0$ by concavity and $Q'(I) \geq 1$. Suppose first that $\widetilde{\omega}_M^c = \overline{\omega}_M^c$. This implies that $\left(I^* - \widetilde{\omega}_M^c\right)\Phi = 0$. But this equality contradicts $I^* > \widetilde{\omega}_M^m$ and $\Phi > 0$. Suppose then that $\widetilde{\omega}_M^m = \overline{\omega}_M^c + \varepsilon$. This yields $\left(I^* - \widetilde{\omega}_M^m\right)\Phi + \varepsilon\left[Q\left(\omega_E + \widetilde{\omega}_M^m\right) - \widetilde{\omega}_M^m\right] = 0$, which again generates a contradiction since $Q\left(\omega_\varepsilon + \widetilde{\omega}_M^m\right) > \widetilde{\omega}_M^m$. It follows that $\overline{\omega}_M^c < \widetilde{\omega}_M^m$, establishing the claim.

Part (ii): Opportunity cost of capital, ρ, enters multiplicatively with respect to the credit lines, $(1 + \rho)L_i$, and the wealth, $(1 + \rho)\omega_i$, under competition. When $\omega_E < \omega_E^c$ and $\omega_M < \underline{\omega}_M^c$, the relevant constraints are given by Eqs. (9) and (10) in the main text. Differentiating Eqs. (9) and (10) with respect to I and ρ using Cramer's rule I obtain $dI/d\rho = -\phi(\overline{L}_E + \overline{L}_M)/\left(1 + \rho + \phi - Q'(I)\right) < 0$, where the inequality follows from Lemma A2. When $\omega_E < \omega_E^c$ and $\omega_M > \underline{\omega}_M^c$, investment is determined by the first-order condition $Q'(I) - (1 + \rho) = 0$, with $dI/d\rho = 1/Q''(I) < 0$, where the inequality follows from concavity. Under monopoly, investment is determined by Eq. (18) in the main text when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$. The modified equation reads, $Q'(I) - (1 + \rho + \phi) = 0$, with $dI/d\rho = 1/Q''(I) < 0$, where the inequality follows from concavity. When $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m]$ the relevant constraints are given by Eqs. (19) and (20) in the main text. Here, ρ only affects the return on the outside option, $(1 + \rho)\omega_i$. Differentiating Eqs. (19) and (20) with respect to I and ρ using Cramer's rule I obtain $dI/d\rho = [\alpha\omega_M(1 - \alpha)\omega_E]/\phi$. The derivative is positive if $\alpha > \alpha^* = \omega_E/(\omega_E + \omega_M)$. As $\alpha \in (\widetilde{\alpha}, 1)$, it suffices to show that $\widetilde{\alpha} \geq \alpha^*$, where $\widetilde{\alpha}$ is given by Eq. (5) in the main text. Subtracting α^* from $\hat{\alpha}$ yields $[Q(\omega_E)(\omega_E + \omega_M) - Q(\omega_E + \omega_M)\omega_E]/\{[Q(\omega_E + \omega_M) - (\omega_E + \omega_M)](\omega_E + \omega_M)\} > 0$, where the inequality follows from concavity. When $\omega_E < \omega_E^m$ and $\omega_M \geq \overline{\omega}_M^m$, investment is determined by the first-order condition $Q'(I) - (1 + \rho) = 0$, with $dI/d\rho = 1/Q''(I) < 0$, where the inequality follows from concavity. □

A.11. Proof of Proposition 10

Proof. Part (i): When $\omega_E < \omega_E^c$ and $\omega_M < \underline{\omega}_M^c$ in the competitive benchmark, the relevant constraints are given by Eqs. (9) and (10) in the main text. Differentiating Eqs. (9) and (10) with respect to I and ϕ using Cramer's rule I obtain $dI/d\phi = -\phi I/[1 + \rho + \phi - Q'(I)] < 0$, where the inequality follows from Lemma A2 (ρ is included to enable a comparison). From the proof of Proposition 9 I have that $dI/d\rho = -\phi(\overline{L}_E + \overline{L}_M)/\left[1 + \rho + \phi - Q'(I)\right]$ and so $|dI/d\phi| > |dI/d\rho|$. Under monopoly, investment is determined by Eq. (18) in the main text when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$. The modified equation reads, $Q'(I) - (1 + \rho + \phi) = 0$, with $dI/d\phi = dI/d\rho = 1/Q''(I) < 0$. When $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$, I have from the proof of Proposition 5 (9) that $dI/d\phi < 0 (dI/d\phi > 0)$ and the conclusion follows.

Part (ii): When $\omega_E < \omega_E^c$ and $\omega_M < \underline{\omega}_M^c$ in the competitive benchmark, the relevant constraints are given by Eqs. (9) and (10) in the main text. Differentiating Eqs. (9) and (10) with respect to I, ω_E, and ω_M setting $d\omega_M = -d\omega_E$ using Cramer's rule I obtain $dI/d\omega_M = 0$. At first best, variation in ω_E and ω_M has no effect on investment. Under monopoly, investment is determined by Eq. (18) in the main text when $\omega_E < \omega_E^m$ and $\omega_M < \underline{\omega}_M^m$, with $dI/d\omega_M = 0$. When $\omega_E < \omega_E^m$ and $\omega_M \in [\underline{\omega}_M^m, \overline{\omega}_M^m)$, the relevant constraints are given by Eqs. (19) and (20) in the main text. Differentiating Eqs. (19) and (20) with respect to I, ω_E, and ω_M setting $d\omega_M = - d\omega_E$ using Cramer's rule I obtain $dI/d\omega_M = (1 - \phi)/\phi > 0$, where the inequality follows from $\phi < 1$. At first best, variation in ω_E and ω_M has no effect on investment. □

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