



The social benefit of being destructive: entrepreneurship and loan diversion

Rosaria Distefano 

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Abstract This paper analyzes the effect of credit costs on the entrepreneurial choice to engage in informal activities. Unlike previous studies, which mainly focus on the decision to divert business assets, we present a model where some entrepreneurs may have the incentive to divert part of the business loan received to illegal or personal uses, rather than investing it in the formal project. We first show that the equilibrium is more likely to be efficient when there is a relatively large proportion of potential diverters. In the case of inefficiency, a regulatory intervention can be welfare improving, but the cost and desirability of the policy depend on whether the proceeds from diversion are classified as a contribution to social welfare or not.

Plain English Summary The informal sector is often analyzed as a response to high taxes and strict regulation. This paper highlights the role of credit costs in driving participation in the informal sector and shows that information asymmetries and excessive credit burden can be crucial in pushing individuals toward the dark side of entrepreneurship. Policy measures, in the form of an interest rate cap, can restore efficiency. However, when informal investments are more profitable than formal ones, the effectiveness of such interventions may be limited, and informality could even be socially desirable.

Keywords Business credit · Entrepreneurial downside · Entrepreneurship · Imperfect information · Policy intervention

JEL Classification D82 · E44 · E50

1 Introduction

Entrepreneurship is mainly conceived as the set of strategies intended to create value. As driver of job creation, entrepreneurship, leads individuals to invest in new businesses, fostering innovation and economic growth. Business loans are crucial for starting new ventures and play a critical role in the success and efficiency of entrepreneurial projects (Beck & Demirgüç-Kunt, 2006).

Growing research is, though, turning increasing attention to the negative aspects of entrepreneurial activities, either unproductive or destructive (Baumol, 1990). Facets of the same rent-seeking behavior both pertain to the (mis)allocation of entrepreneurial resources, but differ in the nature of the ultimate goal they pursue. Unproductive entrepreneurship is often associated with those activities that impair investment productivity, without broader economic and social objectives. In contrast, destructive entrepreneurship is mainly related to illegal or unregulated economic activities, with detrimental effects on society (Shepherd, 2019). Despite the relevance, the research in this field is limited, mostly due to the blurred distinction between

R. Distefano (✉)
Department of Economics and Business, University of Catania,
Corso Italia 55, Catania 95129, Italy
e-mail: rosaria.distefano@unict.it

unproductive and destructive entrepreneurship, but also to the inherent difficulty in measuring concealed activities.

Although business finance is a key determinant of entrepreneurship, little attention has been given to the effect of the cost of capital on the choice to operate in the informal sector. Such a decision has mainly been attributed to excessive taxation and heavy regulation (Blackburn et al., 2012; Guo & Hung, 2020), as well as distrust in public institutions (Schneider & Enste, 2000), corruption, and moral disengagement (Dreher & Schneider, 2010; Qin et al., 2022). In this paper, we contribute to the existing literature by examining the effects of the cost of credit on the misallocation of loanable funds. In the model, we focus on loan diversion, which is a typical moral-hazard problem generally arising when entrepreneurs have access to secondary, informal projects, other than the one formally financed, and when creditors have considerable market power that reduces the borrower's expected net gains from the financial contract. We propose a simple model under imperfect information with a single lender and many would-be entrepreneurs, some of whom may have the incentive to divert part of the loan funds to other private and informal uses.

Our model makes three contributions to the literature. First, we explicitly analyze the entrepreneur's decision on whether and how much of a loan to invest in informal activities.¹ The investment choice is endogenously determined by the “predatory” cost of credit, which erodes the entrepreneurial rent and makes formal projects relatively less profitable. Second, our framework allows borrowers to invest simultaneously in both formal and informal sectors, departing from the existing research, which typically assumes a mutually exclusive choice (Bilicka & Raei, 2023; Dabla-Norris et al., 2008; Levine & Rubinstein, 2017). Third, we consider the spillover effects of diversion on the payoffs of those entrepreneurs who do not engage in informal activities.

It is useful to illustrate the logic of the model by means of a simple example. Consider that some farmers in a rural context are each endowed with two different and independent projects, one formal and one informal.

They have no liquid wealth, but can borrow from a local lender. The formal project involves the cultivation of a piece of land for the production of a cereal, and requires a specific quantity of pesticides, chemicals, and protective devices to prevent infestations or other crop damage. A lower application increases the possibility of plant diseases or pest infestation and thus reduces the probability of a good harvest. The informal project consists of the cultivation of an illicit drug crop, and thus is impossible to formalize in financial contracts. This illegal production requires a variable investment and yields the farmer some private and non-transferable benefits. In this latter case, the formal project acts as a front to secure the loan, which would otherwise be impossible to obtain to finance illegal or personal activities. Farmers are distinguished in productive and potentially destructive types: the former carry out only the formal project, while the latter may be tempted to use part of the loan for the informal investment. The lender faces both problems of hidden information and hidden action, as neither the type of farmer nor the amount invested in the formal planting is observable.^{2,3}

² The same logic may be applied to other similar frameworks. For instance, in the context of tax evasion, taxpayers might have the incentive to underreport their income and use the money for personal purposes rather than contributing to collective goods.

³ We report here some examples related to the diversion of public funds designed to support small and medium enterprises during the pandemic. In 2022, a series of investigations revealed that, in the UK, about £ 17 billion from the Bounce Back Loans program had been diverted to personal expenses, including gambling, luxury cars, home purchases, and flying lessons (BBC News, *Thousands of small firms go bust owing millions in bounce back Covid loans* August 2022). In 2023, in the USA, it was reported that more than \$200 billion from relief loan programs, such as the Economic Injury Disaster Loans and the Paycheck Protection Program, had been either claimed by ineligible firms or misused for personal expenses (CNN Business, *Fraudsters potentially stole over \$200 billion in Covid relief aid, watchdog says*, June 2023). At the European level, other examples report the use of public funds for destructive activities such as corruption, especially in the South of Italy (De Angelis et al., 2020). In addition, between 2021 and 2023, the European Public Prosecutor's Office reported approximately €600 million in fraud related to the post-pandemic Italian National Recovery and Resilience Plan. The funds were obtained by a criminal association and then transferred to shell companies in Slovakia, Romania, and Austria, rather than being used for the declared business purposes (Financial Times, *Italy seizes assets worth €600mn in connection with alleged EU fraud*, April 2024).

¹ Other works focus on ex-post decisions to divert business assets illegally. See, for example, the empirical analysis of Box et al. (2020) in the context of bankruptcy fraud.

We first show that, contrary to expectations, the higher (lower) the proportion of potentially destructive entrepreneurs, the higher (lower) the payoff obtained by *both* types of entrepreneurs. The reason is that loan diversion reduces the probability of success for formal projects and, under limited liability, decreases the likelihood that destructive entrepreneurs will pay back their loans. If the proportion of potential diverters increases, the bank will be forced to reduce the interest rate, so as to hedge against the threat of massive default from destructive types, at the cost of giving up more contract rent to borrowers. Therefore, due to the presence of destructive types, even productive entrepreneurs benefit from lower interest rates and are able to retain some of their project's rent, despite the monopolistic bank. If the proportion of destructive types is particularly high—indicating a poor quality of the entrepreneurial environment—the bank will reduce the interest rate, so that no part of the loan will be diverted into the informal project. Thus, in terms of social welfare, the equilibrium is more likely to be efficient when there is a significantly large number of potentially destructive entrepreneurs.

Another theoretical result of the model is that loan diversion may lead to a social efficiency improvement if the gains from informal activities are included in the welfare function. This result is obtained when diversion is particularly “attractive,” or when the productivity of formal projects is relatively small.⁴ When the equilibrium is inefficient, a regulatory intervention, for instance, an interest rate cap, can be welfare improving. The cost and desirability of the policy, though, depend on whether the proceeds from informal projects are counted as a contribution to welfare or not. When diversion output is not included in the social welfare function and is relatively small, a policy can indeed achieve a Pareto efficient equilibrium, whereas when it is included, an improvement is often not possible

According to the 2020 report from the European Commission's Anti-Fraud Office, countries such as Romania, Slovakia, Czechia, Portugal, and Latvia recorded the highest levels of EU fund fraud between 2007 and 2013. However, these rates may also reflect variations in investigative practices and the effectiveness of anti-fraud measures. (European Parliament, *Identifying Patterns of Fraud with EU Funds under Shared Management - Similarities and Differences between Member States*, January 2022).

⁴ To our knowledge, the only theoretical works in which equilibrium welfare can be larger than under full information are Shneyerov and Wong (2011) and Lauerermann (2012).

and, in any case, this would lessen the need for policy intervention. Moreover, if the informal project is significantly productive, the socially optimal fraction of the loan diverted can even be positive, and efficiency would require some informal sector production. If this is the case, a policy intervention would never lead to a Pareto improvement.

Throughout the paper, we adopt a utilitarian measure of social welfare, defined as the sum of the economic profits of both the bank and the entrepreneurs. We do not consider other aspects that may be related to the concept of social welfare, such as wealth distribution, public safety, equity, or societal moral values.⁵ Our framework, though, allows for the possibility that informal activities may sometimes be more productive than formal projects. Examples include illegal activities whose returns may widely exceed those of legal projects, or the informal sector in developing economies and marginalized areas of more developed countries, where it plays a crucial role in employment creation, poverty alleviation, and economic resilience (de Soto, 1989). This utilitarian definition of social welfare enables us to capture the dual nature of informal activities. While they deviate from legal frameworks and may undermine the expected productivity of formal projects, their short-term contributions to societal well-being can be substantial, particularly in specific social and economic contexts.⁶

Although destructive entrepreneurs are supposed to create value mainly for themselves rather than for broader social purposes (Acs et al., 2013), the question of whether introducing illegal activities in the national accounts has been debated by academics and policy-makers.⁷ Including these illegal activities in national

⁵ We acknowledge that the level and distribution of welfare would change if these aspects were considered, as for example by adopting the Rawlsian perspective based on the wellbeing of the worst-off members of society, or using other measures based on life satisfaction and other proxies for happiness.

⁶ We acknowledge that in well-regulated credit markets, or perfectly competitive banking sectors, competition would maximize the surplus of formal projects, and informal activities would be unlikely to emerge, except among marginal groups within developed societies. Whereas, in contexts where lenders hold significant market power and the access to credit is limited, such as in developing countries, entrepreneurs may turn to informal activities or engage in illicit behaviors to supplement their income.

⁷ In 2010, the European System of National and Regional Accounts established a new methodology that allows EU countries to include estimates of part of the black economy (prostitu-

accounts allows governments to inflate economic indicators, though ignoring long-term costs on society.⁸ For instance, informality depresses public revenue, crucial for the provision of essential services like health-care and education, while a culture of rule-breaking erodes cohesion and ethical foundations of society. But, in environments characterized by high corruption and poor governance, the informal economy may operate more efficiently due to reduced regulatory burdens and greater bureaucratic flexibility, thereby enhancing social welfare in the short term.

In real-life economic situations, the contribution of destructive entrepreneurship to social welfare strictly depends on the quality of the institutional environment. For example, in well-regulated market economies, such as liberal democracies, the illegal and informal sectors are likely to be relatively small compared to the formal economy. In contrast, in centralized economies, such as the restrictive socialist regimes of the recent past, informal activities may have enhanced social welfare by circumventing some systemic inefficiencies. State ownership and bureaucratic control of economic activity often resulted in drastic shortages of consumption goods (Kornai, 1979), and in the emergence of black markets.⁹ These parallel markets, while officially condemned, were often tolerated by the authorities (Sampson, 1988). Other than a remedy for shortages, these markets were also sources of basic income opportunities for individuals, who engaged in various forms

tion, drug trafficking, counterfeit goods) in their Gross Domestic Product to provide a more accurate measure and reduce the inconsistencies in national accounts across countries.

⁸ According to the OECD, the inclusion of illegal activities has produced an increase in the GDP of 1% in Italy, 0.9% in Spain and, 0.6% in the United Kingdom (Handbook on the compilation of statistics on illegal economic activities in national accounts and balance of payments - Sects. 3.4–3.6).

⁹ In the model, the bank has a monopolistic power, which seems to be a salient feature of centralized credit markets, as for example the socialist economies of the past or the current developing countries. In such systems, the lack of a credible bankruptcy threat for firms—soft budget constraint (Kornai, 1979)—has been identified as a primary cause of the proliferation of inefficient industries. On this topic, Maskin and Dewatripont (1995) show that a decentralized banking system can serve as a mechanism to screen out inefficient projects, for instance, because the lack of easy refinancing conditions can force entrepreneurs to implement high-quality projects, enhancing overall efficiency. However, as noted by Maskin and Xu (2001), this approach can lead to an overemphasis on short-term profit opportunities, potentially neglecting long-term growth and sustainability, as well as long-term social costs.

of informal entrepreneurial activities otherwise stifled by economic policies.¹⁰ This is an example of how illegal and often destructive economic activities can sometimes have short-term positive effects on social well-being, and can lend some support to our policy implications.¹¹

1.1 Theoretical framework

Our paper is related to the literature on destructive entrepreneurship, which focuses on the motivations of entrepreneurs to engage in illegal and/or informal activities, other than their formal businesses. Examples include economic crimes such as illegal gambling, drug production, corruption, and bankruptcy fraud (Box et al., 2020; Collins et al., 2016). These criminal activities fall within the realm of the destructive side of entrepreneurship, which, along with dark and downside, constitutes the “Triple Ds” (De Sordi et al., 2022; Shepherd, 2019).

Our analysis suggests that while high interest rates push entrepreneurs toward the informal economy, lower interest rates pull them toward the formal economy.¹² Our findings may be supported empirically by the literature examining the relationship between informal economy and financial development, formalized as a lower cost of credit. For example, Capasso et al. (2022) report that lower interest rates significantly reduce the incentive to operate in the informal sector, making formal investments more attractive. Gharleghi and Jahanshahi (2020), using panel data from 29 countries over the period 1975–2015, find evidence of a negative relationship between financial development and the size of the informal economy. Similarly, Canh and Thanh (2020), analyzing data from 114 countries from 2002 to 2015, show that credit costs are more effective in reducing the size of the informal sector than other measures of financial development, such as access to credit or financial depth. Yet, Omri (2020), using a panel data from 19 emerging countries, finds

¹⁰ According to Shleifer and Vishny (1992), goods shortages were deliberately created by state-firm bureaucrats to secure side payments, which were exempt from state rent extraction, and counteract the actions of self-interested social planners.

¹¹ We thank an anonymous referee for suggesting this argument.

¹² For insights on the role of credit costs on the occupational choice of necessity and opportunity entrepreneurs, see Distefano (2024).

a positive and significant effect of financial development on formal entrepreneurship and show that better governance amplifies such an effect.

Our paper is in line with the theoretical literature on the welfare implications of credit market frictions. On this topic, Burkart and Ellingsen (2004) analyze a banking model in which borrowers can divert investment resources to personal uses. They argue that trade credit can be an efficient substitute for financial loans, thanks to input illiquidity and the monitoring advantage of suppliers over banks. Similarly, Repullo and Suarez (2000) consider both market and bank finance, and assume that the latter involves a higher monitoring activity that may reduce the problem of loan diversion.¹³ Madestam (2014) focuses on the coexistence of formal and informal lenders and shows that the inability of the legal system to enforce contracts leads to an increase in loan diversion. Our results are also close to those of Navajas et al. (2003), who analyze the impact of interest rates on the strategic behavior of borrowers and show that “unfair” rates may increase the incentive to misallocate financial flows.¹⁴ On the empirical side, measuring loan diversion is not straightforward. Many papers focus on the legal protection of investors and try to provide indirect proxies and indicators of diversionary tactics. La Porta et al. (2002) find that the lower the legal protection, the lower the valuation of firms on financial markets, and this may be interpreted as a signal of resource misallocation. Durnev and Kim (2005) report that, as protection becomes weaker, managers tend to divert a higher share of returns to their own advantage, at the expense of shareholders.

The model presented is particularly relevant in contexts where access to credit is crucial in fostering entrepreneurship but is also prone to misuse due to weak law enforcements or informational opacity (Berger & Udell, 2002). Real-world examples include less-developed countries, where poor individuals often turn to informal lenders, such as relationship or shadow banking, which charge prohibitive interest rates (Beck et al., 2004; Howorth & Moro, 2012). In these contexts, informal activities tend to be more unproductive than destructive, but are crucial in alleviating poverty.

¹³ Bougheas (2004) shows that if bank’s monitoring is imperfect, firms may have the incentive to misuse resources intended to finance investments in intangibles.

¹⁴ See Coco (2000) for a brief review on diversionary models.

Garikipati (2013) and Mungai et al. (2014) report that acute poverty may force households to use borrowed money for basic family needs like consumption goods, healthcare, and children’s education, expenses that, while unproductive, significantly contribute to social well-being. La Porta and Shleifer (2008) report that regulatory interventions aimed at formalizing these activities could lead to widespread shutdowns, with severe consequences for unemployment and social welfare. Similarly, Fredström et al. (2021) find empirical evidence that, in countries where the informal sector is particularly large, government interventions can be counterproductive. These findings provide further support to our theoretical results.

Other real-world examples include microfinance initiatives in developing countries, where business loans are often diverted to informal activities. In our theoretical model, entrepreneurs lack personal wealth to guarantee their loans, and lenders have sufficient market power to extract all the entrepreneurial rent. These two aspects are typical of the literature on microfinance institutions (MFIs). Although MFIs aim to provide credit access to poor individuals excluded from traditional banking systems due to their inability to offer collateral (Armendáriz & Szafarz, 2011), many theoretical and empirical works reveal that their mission has shifted from social outreach to financial performance (Cull et al., 2007; Madajewicz, 2003). For example, Kar and Swain (2014) report that the interest rates charged are far higher than normal bank rates and, according to Banerjee (2013), the global average interest rate is around 35–40%, or even above 80%.¹⁵ In line with our theoretical results, the empirical findings of Banerjee et al. (2015) show that the excessive cost of microfinance lending is the main cause of loan diversion.¹⁶

The next section introduces the model. Then, we describe the equilibrium and discuss the welfare and policy implications. Finally, some brief conclusions are drawn. All (non-trivial) proofs are in the Appendix.

¹⁵ Other empirical evidence on pure *for-profit* microfinance institutions is reported in de Quidt et al. (2011), which also present a theoretical model with a single monopolistic lender, and Guha and Roy Chowdhury (2013), and Caserta et al. (2018).

¹⁶ Analyzing interlinkages, with data on mills’ contracts in colonial Taiwan, Koo et al. (2012) show that high interest rates can lead borrowers to divert crop proceeds for personal uses.

2 Model development

Consider a one-period, risk-neutral credit market with a large number of would-be entrepreneurs. At the beginning of the period, each entrepreneur is endowed with two different and independent projects, which we will refer to as formal and informal projects. The formal project requires 1 unit of capital, yields output, y , and gives entrepreneurs profit/utility $u(\cdot)$, increasing and (weakly) concave. The informal project requires a variable amount of capital and generates an output increasing and strictly concave in the amount of funds invested. Entrepreneurs have no initial wealth, and to undertake their projects need external financing, which can be provided by a single lender/bank. The returns of informal projects are illicit or unverifiable, so the bank will only consider loan applications for formal projects. We restrict attention to debt contracts, which specify the loan advanced, equal to the capital cost of 1, and the repayment (principal plus interest), r , made in case of project success.¹⁷ Implicitly, the contract contains the clause that the loan money cannot be used for other purposes than the formal investment. To simplify, we consider limited liability on the part of entrepreneurs, and a risk-free rate normalized to 0.

Entrepreneurs are of two types, differentiated by their attitudes towards the organization and implementation of the two projects. Specifically, there are “productive” (P) and (potentially) “destructive” (D) and entrepreneurs. P entrepreneurs do not derive any utility from the informal activity, so they are expected to undertake only the formal project, producing the output y with certainty. D entrepreneurs may have the incentive to invest a fraction, $\delta \in [0, 1]$, of the loan in the informal project, deriving private utility and lowering the probability of success for the formal project down to $\rho(\delta)$, with $\rho'(\delta) < 0$, $\rho''(\delta) \leq 0$, $\rho(0) = 1$, and $\rho(1) = 0$. That is, they have the ability to scale down the investment size of the formal project, at the cost of higher failure risk.¹⁸ This setup is consistent with the

argument of Diamond (2004), in which earnings are not contractible when borrowers can easily divert or hide their cash flow. In our case, loan diversion is more (infinitely) costly for P types and less for D types.

We denote private utility from the informal project as $f(\delta, \theta)$, with $f_\delta > 0$, $f_{\delta\delta} < 0$ and $f_\theta > 0$. The parameter θ can be interpreted as the utility weight or productivity parameter of the informal project and can reflect, for example, the profitability, social acceptance, stigma, security, and legal risks associated with this activity.

To simplify the analysis, we do not consider any monitoring activity during the investment stage of the formal project, for example, because of high implementation costs or a weak enforcement system, so the quantity of funds diverted by D borrowers is unobservable.¹⁹ The bank cannot distinguish between the two types of entrepreneurs, but knows the proportions of P and D types in the population, denoted as $1 - \lambda$ and λ respectively. In particular, the quantity of loans the bank can make is large enough so that the relative proportions of borrowers’ types—quality of the entrepreneurial environment—can be perfectly estimated and are assumed to be public knowledge.²⁰

ments to qualify for financing, without compromising the basic standards established for the legal or material operation of the business.

¹⁹ Although monitoring and strict sanctions are key tools to reduce illegal behaviors, their effectiveness can vary depending on the institutional context. For example, in certain institutional settings, control and monitoring mechanisms may be ineffective or easily circumvented. This is particularly true in contemporary hybrid systems such as Turkey, Russia, and Venezuela, where large corporations with political connections often bypass formal regulations and engage in illicit activities with impunity. In contrast, smaller firms, which typically lack such influence, may face financial pressures that outweigh the perceived risk of being caught, even in the presence of strong sanctions Diamond (2002).

²⁰ This is in line with most of the literature arguing that the “quality of entrepreneurial environment” can be estimated using past performances or credit-score techniques (Minelli & Modica, 2009) digital footprints (Berg et al., 2020), machine learning (Fuster et al., 2022), or information spillovers (Balyuk, 2023). The quality of the environment can be influenced by a number of economic and political factors. For instance, Minelli and Modica (2009) posit how public investments in basic infrastructures can affect the development of the entrepreneurial sector and its key characteristics. They also discuss of the role of the extraordinary interventions on basic infrastructures pursued by the Italian government shortly after World War Two to reduce the gap between the industrialized North and the less-developed South, and motivated by the extremely poor quality of the entrepreneurial environment prevailing in the latter area.

¹⁷ It is possible to show that, in our case, with asymmetric information and where monitoring is unfeasible, equity contracts between the bank and each entrepreneur would leave the theoretical conclusions unchanged.

¹⁸ The combination of fixed loan size and potential diversion of investment funds is used, among others, by Diamond (2004), Repullo and Suarez (2000), Wydick (2001). The justification for the assumption of fixed loan size may be that formal projects must meet some minimum technical require-

As neither the informal investment nor the type of entrepreneur can be observed by the bank, the credit market is characterized by both hidden actions and hidden information. At the end of the period, however, the bank can observe the formal project output. To simplify, we also assume that no penalty can be imposed on defaulters, for example, due to institutional constraints (contracts based on *ex-post* verification would be equivalent to the debt structure introduced here, as long as the bank can pre-commit to an *ex-ante* fixed repayment).²¹

The timing of the game is: 1) nature determines y , θ and λ ; 2) the bank offers the contract, loan repayment, $(1, r)$; 3) P and D individuals decide whether to accept or not; 4) if D types accept, they choose δ and obtain $f(\delta, \theta)$ from informal projects; 5) the formal project output is realized and state-contingent payments are made.

Had we symmetric information, the bank would force D types not to divert any funds ($\delta = 0$), and set the repayment equal to the whole output, $r = y$ (a higher repayment would not be accepted). Each entrepreneur would obtain their reservation payoff of zero, the bank the full-information profit, $y - 1$, which is assumed to be positive (otherwise, the bank would not finance any project). Under perfect information, the bank is able to extract all the rent from the financial contract. This may provide a rationale for why D entrepreneurs may want to activate the informal project if information is asymmetric, as shown below.

3 Equilibrium analysis

In what follows, we describe the equilibrium conditions under the pooling contract/debt repayment r . The expressions for the expected profits by P and D entrepreneurs are:

$$\pi_P(r) = u(y - r); \quad (1)$$

$$\pi_D(r) = f(\delta, \theta) + \rho(\delta)u(y - r). \quad (2)$$

The fraction of funds diverted by each D type is obtained from the maximization of Eq. 2, with solution

²¹ An alternative approach may be that of assuming that the P type's output is stochastic, and that the diversion activity of D types further reduces the probability of project success. If this is the case, after observing the default, it would not be possible for the lender to ascertain whether failure is due to loan diversion or simply to bad luck.

deriving from

$$f_\delta(\delta, \theta) + \rho'(\delta)u(y - r) \gtrless 0, \quad (3)$$

where the first term is the marginal benefit from diversion, while the second is the marginal cost, in terms of the lower probability of a positive output from the formal project.²² We denote the solution, either interior or corner, by $\delta(r, \theta)$.

The expression for the lender's expected profit (per borrower) is

$$\pi_B(r) = \lambda\rho(\delta)r + (1 - \lambda)r - 1, \quad (4)$$

where, if the entrepreneur is of type D (P), the lender obtains r with probability $\rho(\delta)$ (1). Taking into account the participation—individual rationality—constraint of P types and the reaction function of D types, the lender's maximization problem is

$$\max_r \pi_B(r) \quad s.t. \quad (5)$$

$$\pi_P(r) \geq 0; \quad (\mu_P) \quad (6)$$

$$\delta(r, \theta) \geq 0, \quad (\mu_D) \quad (7)$$

with μ_P and μ_D being the Lagrangian multipliers. Depending on which constraint binds, three scenarios are possible, which will be derived and discussed below.

3.1 Full-diversion

If $\mu_P > 0$, $\mu_D = 0$, the P type's participation constraint is binding and the constraint in Eq. 7 is slack. The bank will set r such that $\pi_P(r) = u(y - r) = 0$, that is $r = y$, equal to the full-information level. At this repayment level, the formal investment does not produce any rent, while the marginal cost of diverting resources reduces to zero, so D types will choose to allocate the entire loan to the informal project and $\delta(r, \theta) = \delta(y, \theta) = 1$. Therefore, at $r = y \equiv r_{\max}$, the bank makes profits exclusively from P types.

Note that a repayment larger than $r_{\max}$ would drive P types out of the market, and the bank's profit would become negative. Thus, $r_{\max}$ is the highest possible

²² The second-order condition is satisfied, as shown in the Appendix.

repayment in this framework, and we can state the following:

Lemma 1 *In equilibrium, there is no adverse selection, as the lender will never set a repayment such that P types drop out of the market.*

In this regime, the bank receives the loan repayment exclusively from P entrepreneurs, so its expected profit is

$$\pi_B(r_{\max}) = (1 - \lambda)y - 1, \quad (8)$$

which is lower than the full-information profit, decreasing in λ and equal to 0 as λ tends to 1.

The payoffs of the two types of borrowers are

$$\pi_P(r_{\max}) = 0, \quad (9)$$

$$\pi_D(r_{\max}) = f(1, \theta), \quad (10)$$

so P types obtain their reservation payoff, while D types get the maximum output from the informal investment.

3.2 No-diversion

If $\mu_P = 0$, $\mu_D > 0$, the participation constraint of P types is slack, while the constraint Eq. 7 is binding. The bank will set a repayment such that D types have no incentive to divert any fraction of the loan, that is, such that $\delta(r, \theta) = 0$. We will denote this repayment by $r_{\min}$. For any $r < r_{\min}$, D borrowers would still choose not to divert, but the expected profit to the bank would be lower, so $r_{\min}$ is the lowest repayment level in this setup.

In equilibrium, the lender obtains

$$\pi_B(r_{\min}) = r_{\min} - 1, \quad (11)$$

which does not depend on λ , as D borrowers do not divert any fraction of the loan, while the two types of entrepreneurs obtain the same equilibrium payoff,

$$\pi_D(r_{\min}) = \pi_P(r_{\min}) = u(y - r_{\min}), \quad (12)$$

By construction $r_{\min} < r_{\max}$, so in this regime borrowers—and thus even productive types—obtain a payoff larger than their outside option. In particular,

$u(y - r_{\min})$ represents the highest payoff that they can achieve in this model setup. As will be shown below, the magnitude of the equilibrium repayment will depend on the utility weight of informal returns, and specifically, $r_{\min}$ is increasing in θ . This implies that, if the informal project is particularly valuable, an equilibrium at $r_{\min}$ may not be feasible.

3.3 Partial-diversion

If $\mu_P = 0$, $\mu_D = 0$, the P type's participation constraint and the constraint Eq. 7 are both slack, so the optimal diversion fraction is $\delta(r, \theta) \equiv \tilde{\delta} \in (0, 1)$. From the condition in Eq. 3,

$$\frac{d\tilde{\delta}}{dr} = \frac{\rho'(\delta)u'(y-r)}{\rho''(\delta)u(y-r)+f_{\delta\delta}(\delta,\theta)} > 0, \quad (13)$$

where the sign follows from the concavity of $f(\delta, \theta)$ and from $\rho'(\delta) < 0$. Thus, as r increases, D types will choose to divert more and more resources into the informal project.

The bank faces an unconstrained maximization problem, with the first-order condition

$$(1 - \lambda) + \lambda\rho(\delta) + \lambda\rho'(\delta)r\frac{d\tilde{\delta}}{dr} = 0, \quad (14)$$

for which the benefit from a marginal increase in r is equal to the marginal cost, in terms of a higher diversion fraction or lower probability of receiving the repayment from D types. We will denote the solution by $\tilde{r}$. Note that Eq. 14 implies that the profit-maximizing repayment is decreasing in λ , as

$$\frac{d\tilde{r}}{d\lambda} = -\frac{\rho(\delta)+\rho'(\delta)r\delta_r(r,\theta)-1}{\lambda\rho'(\delta)r[\delta_r(r,\theta)]^2+\lambda\rho'(\delta)[2\delta_r(r,\theta)+r\delta_{rr}(r,\theta)]} < 0, \quad (15)$$

whose sign is proven in the Appendix. Thus, higher levels of λ lead to a higher potential loss from the loans granted to D borrowers, implying that, if their proportion in the population is relatively high, the bank will be forced to reduce the repayment to discourage a massive misallocation of funds.

In equilibrium, the lender obtains the repayment from both P and D entrepreneurs, but with different probabilities, leading to expected profit

$$\pi_B(\tilde{r}) = [1 + \lambda\rho(\tilde{\delta}) - \lambda]\tilde{r} - 1, \quad (16)$$

which can be shown is decreasing in the proportion λ .

The fraction of funds diverted by D types at $\tilde{r}$ is decreasing in λ , as

$$\frac{d\tilde{\delta}}{d\lambda} = \frac{d\tilde{\delta}}{d\tilde{r}} \cdot \frac{d\tilde{r}}{d\lambda} < 0, \quad (17)$$

where the sign derives from Eqs. 13 and 15. We therefore obtain the following key preliminary result.

Lemma 2 *In the partial-diversion equilibrium, the higher the proportion of D types, the lower the fraction of the loan diverted.*

At $\delta = \tilde{\delta}$, the equilibrium payoffs of borrowers are

$$\pi_P(\tilde{r}) = u(y - \tilde{r}), \quad (18)$$

$$\pi_D(\tilde{r}) = f(\tilde{\delta}, \theta) + \rho(\tilde{\delta})u(y - \tilde{r}). \quad (19)$$

In this regime, the bank can take advantage of cross-subsidization between the two types of entrepreneurs: P types bear most of the credit burden, while D types are able to shift part of their debt liabilities.

3.4 Equilibrium regime

In this subsection, we characterize the equilibrium in terms of the fraction, λ , of D entrepreneurs in the population.

First, note that from the condition in Eq. 15, $\tilde{r}$ is differentiable and thus continuous in $\lambda \in [0, 1]$. It follows that we can find two thresholds of λ such that $\tilde{r} = r_{\max}$ and $\tilde{r} = r_{\min}$, and denoted respectively by $\underline{\lambda}$ and $\bar{\lambda}$. Since $\tilde{r}$ is decreasing in λ and $r_{\max} > r_{\min}$, it follows that $\underline{\lambda} < \bar{\lambda}$, and we can state the following results.

Lemma 3 *There exists a unique $\underline{\lambda} \in (0, 1)$ such that, in the interval $[0, \underline{\lambda}]$, the equilibrium repayment is $r_{\max}$.*

Therefore, an equilibrium in which destructive entrepreneurs decide to divert all the loans received is possible only when their proportion in the population is relatively low. The intuition is that, in this case, the losses that the lender incurs from non-performing loans can be easily covered by the extra profits made on productive borrowers.

Lemma 4 *If θ is not too large, there exists a unique $\bar{\lambda} \in (0, 1)$ such that, in the interval $[\bar{\lambda}, 1]$, the equilibrium repayment is $r_{\min}$.*

A no-diversion equilibrium may exist when λ is relatively large. That is, an environment in which potentially destructive entrepreneurs will ultimately translate into the most profitable formal investment projects for them, due to the lowest cost of credit. As will be shown in the numerical example below, if the informal project is significantly remunerative, the no-diversion regime will no longer exist.

Lemma 5 *The partial-diversion equilibrium repayment is such that $r_{\min} < \tilde{r} < r_{\max}$.*

From the above analysis, we can distinguish three relevant intervals, $[0, \underline{\lambda}]$, $(\underline{\lambda}, \bar{\lambda})$, and $[\bar{\lambda}, 1]$, which will correspond respectively to the *full-diversion*, *partial-diversion*, and *no-diversion* regimes.²³ The discussion of this section leads to the following

Proposition 1 *The higher the proportion of D entrepreneurs, the higher the surplus that both types of borrowers can obtain.*

As noted in the introduction, the propensity of “bad” borrowers to divert the loan forces the bank to charge a low lending rate, and this benefits also “good” borrowers. This effect is intensified when bad borrowers are particularly numerous. Except when the number of D types is very low, both types of borrowers earn a positive expected payoff, despite the presence of a monopolistic lender. This result is in contrast to most of the literature on credit market imperfections, for example Akerlof (1970), where an equilibrium in which only lemons are sold is more likely to occur when their proportion is relatively high, and Stiglitz and Weiss (1981) and de Meza et al. (1987), where a higher fraction of high-risk borrowers increases the pooling interest rate. The same conclusion is reached in Minelli and Modica (2009), where the credit sector is in monopoly, and in Dewatripont and Maskin (1990, 1995), where the presence of bad projects discourages long-term but profitable investments from being refinanced.

3.5 Numerical example

Here, we provide a numerical example of the equilibrium regimes described above. We will use the following form for the diversion utility of D types, $f(\delta, \theta) =$

²³ As will be shown in the numerical example, if the parameter θ is relatively high, the threshold $\bar{\lambda}$ can be larger than 1. If this is the case, the equilibrium repayment is $\tilde{r}$ in the whole sub-interval $(\underline{\lambda}, 1]$, which will correspond to the partial-diversion regime.

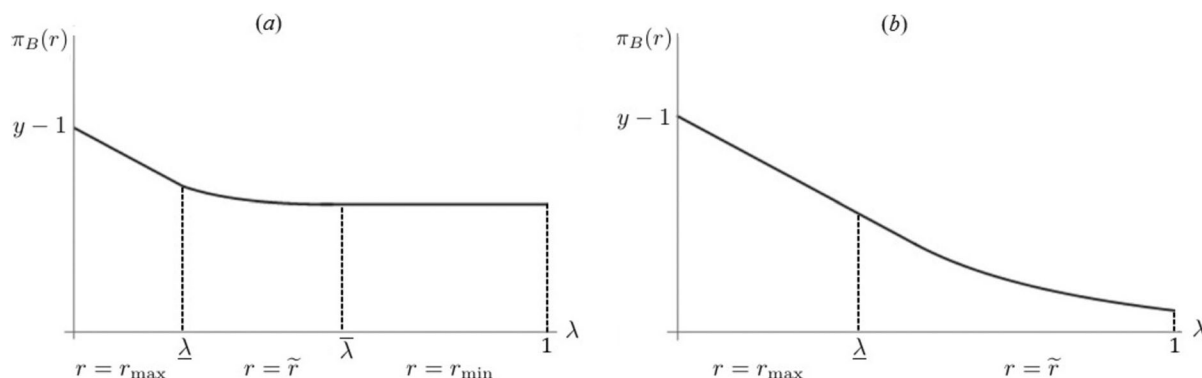


Fig. 1 Bank's profit. Numerical example. **a** $y > 2\theta$. Parameters: $y = 6$; $\theta = 2.5$. **b** $y \leq 2\theta$. Parameters: $y = 6$; $\theta = 4.5$

$\frac{\theta}{2}[1 - (1 - \delta)^2]$, with $\theta > 0$. We assume that diversion linearly reduces the probability of the formal output down to $\rho(\delta) = 1 - \delta$, and that $u(y - r) = y - r$. The optimal interior diversion choice derives from the maximization of $\pi_D(r) = \frac{\theta}{2}[1 - (1 - \delta)^2] + (1 - \delta)(y - r)$, yielding $\delta(r, \theta) = 1 - \frac{y-r}{\theta}$, increasing in r (the second-order condition is satisfied). Depending on the repayment set by the bank, the fraction of the loan diverted can be either interior or corner, so in equilibrium,

$$\delta(r, \theta) = \begin{cases} 1, & \text{if } r_{\min} = y - \theta; \\ 1 - \frac{y-r}{\theta}, & \text{if } \tilde{r} = \frac{\lambda y + (1-\lambda)\theta}{2\lambda}; \\ 0, & \text{if } r_{\max} = y. \end{cases}$$

From the repayment levels derived above, we can compute the two critical thresholds of λ :

$$\begin{aligned} \tilde{r} = r_{\max} &\Leftrightarrow \underline{\lambda} = \frac{\theta}{y+\theta}; \\ \tilde{r} = r_{\min} &\Leftrightarrow \bar{\lambda} = \frac{\theta}{y-\theta}. \end{aligned}$$

Note that $\tilde{r}$ is increasing in θ , as the higher the productivity of informal projects, the higher the fraction diverted and thus the repayment on formal loans. The threshold $\bar{\lambda}$ is equal to 1 when $y = 2\theta$, whereas if $y < 2\theta$, $\bar{\lambda} > 1$ and the no-diversion regime does not exist. As depicted in Figs. 1 and 2, depending on θ , there can be either three or two equilibrium intervals.

In the interval $[0, \underline{\lambda}]$, which corresponds to the full-diversion regime, the bank obtains the profit in Eq. 8, linear and decreasing in λ . Under the partial-diversion regime, the profit is $\pi_B(\tilde{r}) = [\lambda y + (1-\lambda)\theta]^2 / 4\lambda\theta - 1$, either over the interval $(\underline{\lambda}, \bar{\lambda})$ if $y > 2\theta$ as shown in

Fig. 1a, or over the interval $(\underline{\lambda}, 1)$, as shown in Fig. 1b.²⁴ As expected, the higher λ , the lower the lender's profits.²⁵ If $y > 2\theta$, $\bar{\lambda} < 1$ and an equilibrium at $r_{\min}$ exists. If this is the case, the expected profit to the lender is $\pi_B(r_{\min}) = y - \theta - 1$, which does not depend on λ .

Using the functional form for $f(\delta, \theta)$, D types obtain: $\pi_D(r_{\max}) = \theta/2$ in the full-diversion regime, when $\lambda \in [0, \underline{\lambda}]$; $\pi_D(\tilde{r}) = \theta/2 + [\lambda y - (1-\lambda)\theta]^2 / 8\lambda^2\theta$ in the partial-diversion regime, when either $\lambda \in (\underline{\lambda}, \bar{\lambda})$ or $\lambda \in (\underline{\lambda}, 1)$; $\pi_D(r_{\min}) = \theta$ in the no-diversion regime, when $\lambda \in (\bar{\lambda}, 1)$, when this equilibrium exists.

The equilibrium payoff of P types is: $\pi_P(r_{\max}) = 0$ in $(0, \underline{\lambda}]$; positive and equal to $\pi_P(\tilde{r}) = \lambda y - (1-\lambda)\theta/2\lambda$ in either $(\underline{\lambda}, \bar{\lambda})$ or $(\underline{\lambda}, 1)$, and $\pi_P(r_{\min}) = \theta$ in $(\bar{\lambda}, 1)$ (if the no-diversion equilibrium is possible). Note that, when $y > 2\theta$, in the no-diversion regime, borrowers obtain less than the project's output but, due to the significantly large presence of D entrepreneurs in the population, both types can earn a positive payoff, as shown in Fig. 2a and b. Therefore, as λ increases, the payoffs of both D and P entrepreneurs become larger.

The data presented in Table 1—though should not be viewed as empirical evidence—appear to support our conclusion that the fraction of funds diverted—proxied by the share of non-performing loans—is positively correlated with the interest rates charged by lenders. Of course, the co-movement of interest rates and non-

²⁴ It can be shown that $\pi_B(\tilde{r})$ is a non-rectangular hyperbola with vertical asymptote at $\lambda = 0$, and with the right branch decreasing in the range $(\underline{\lambda}, \bar{\lambda})$.

²⁵ To restrict the analysis, we consider that $\theta < y^2/4$, which implies that $\pi_B(\tilde{r})$ is always positive and an equilibrium at $\tilde{r}$ exists, whether in the interval $(\underline{\lambda}, \bar{\lambda})$ or $(\underline{\lambda}, 1)$.

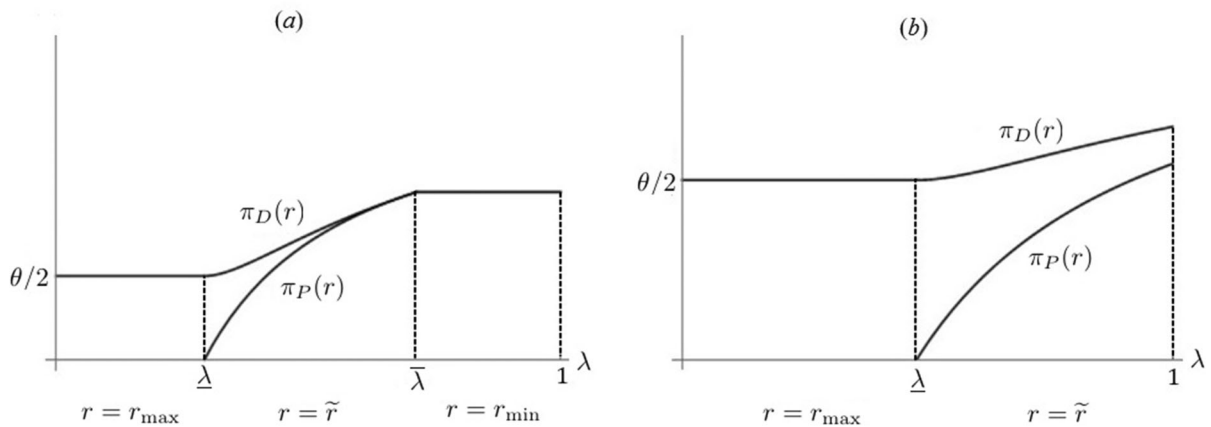


Fig. 2 Payoffs of P and D borrowers. Numerical example. **a** $y > 2\theta$. Parameters: $y = 6$; $\theta = 2.5$. **b** $y \leq 2\theta$. Parameters: $y = 6$; $\theta = 4.5$

performing loans can also be affected by other factors, such as the degree of political stability. For instance, countries such as Iraq, Lebanon, and Bangladesh have high levels of non-performing loans alongside unstable political environments, whereas countries like Switzerland, the Netherlands, and the United Kingdom tend to have lower levels of non-performing loans.

The main prediction of the model is that diversion is more likely to occur when there is a relatively high proportion of entrepreneurs who comply with the contract terms— P types in our model. This result seems to be supported by the data in Table 2, which shows

that countries with a high crime index in general can have low levels of non-performing loans, despite a large bank concentration. For instance, Argentina has a high crime index (63.8) and a share of non-performing loans below the average (3.9%). Whereas, in Cyprus, where the crime index is low (31.3), the share of bad loans is above the average (15.0%). The crime index is influenced by the severity of legal punishments, but also by the individual attitudes towards formal institutions. Countries with high levels of social distrust, like Guatemala (42.3%) and Mexico (53.8%), tend to have high levels of crime (58.7% and 54.2%).

Table 1 Lending interest rate, non-performing loans, and political stability

Country	Lending interest rate (%)	Non-performing loans (%)	Political stability (%)
Congo	26.0	23.1	40.1
Iraq	12.4	16.2	1.9
Lebanon	10.5	15.2	8.0
Zambia	9.5	11.6	43.4
India	9.2	7.9	18.4
Bangladesh	8.3	7.7	15.6
China	4.3	1.8	27.8
United States	3.5	1.1	47.6
Switzerland	2.6	0.7	91.5
Italy	2.3	4.4	58.0
Netherlands	1.5	1.9	73.6
United Kingdom	0.5	1.2	61.3

Source: Bankscope, World Bank, World Development Indicators

Countries are ranked by lending interest rate and non-performing loans. In 2020, the average of bad loans based on 102 countries was 5.86%. Political stability refers to the percentile rank according to World Development Indicators

Table 2 Crime index, non-performing loans, and bank concentration

Country	Crime index	Non-performing loans(%)	Bank concentration (%)	Government distrust
Argentina	63.8	3.9	41.4	30.8
Guatemala	58.7	1.8	65.9	42.3
Malaysia	57.3	1.6	55.4	13.5
Mexico	54.2	2.4	49.4	53.8
France	52.0	2.7	57.1	31.9
Ethiopia	49.3	3.4	80.8	14.4
Sweden	48.0	0.5	91.1	9.6
United States	47.8	1.1	34.8	29.0
United Kingdom	46.1	1.2	49.1	25.2
Italy	44.9	4.4	71.1	26.7
Canada	41.9	0.5	60.5	14.7
Cyprus	31.3	15.0	75.5	21.7

Source: Bankscope, World Population Review

Countries ranked by crime index in 2020. The crime index is expressed per 100,000 people. Bank concentration represents the percentage of bank assets held by the top three banks. Government distrust reflects the share of respondents indicating “no confidence at all” in the government, with data drawn from the World Value Survey (WVS Q71)

4 Welfare analysis and policy

In this section, we determine the equilibrium and socially optimal welfare, and analyze the potential divergences between these two measures. The social optimum depends on whether the utility from diversion, $f(\delta, \theta)$, is included or not in the social welfare and, in the following, we will discuss how this distinction may lead to different levels of δ maximizing welfare.²⁶ We will denote welfare (per borrower) when diversion is respectively included and excluded by $\omega^{in}(\delta)$ and $\omega^{ex}(\delta)$. To simplify, we assume that the institutional decision to factor in informal activities does not affect the diversion utility weight, θ . In addition, we assume

that, even though the government cannot distinguish between the two types of entrepreneurs or determine the amount of the business loan diverted, it can estimate the ex-post output of the informal or illegal activity.²⁷

If $f(\delta, \theta)$ is excluded from welfare, the socially efficient diversion fraction derives from

$$\max_{\delta} \omega^{ex}(\delta) = [1 + \lambda\rho(\delta) - \lambda]y - 1, \quad (20)$$

that is by maximizing the sum of the lender's and (average) borrower's profits. Since $d\omega^{ex}(\delta)/d\delta < 0$, the solution to the problem in Eq. 20 is $\delta = 0$, and optimal welfare is equal to the full-information welfare, $\omega^{ex}(0) = y - 1 \equiv \omega^{FI}(0)$.

If, instead, $f(\delta, \theta)$ is included in welfare, the optimal diversion fraction derives from

$$\max_{\delta} \omega^{in}(\delta) = \lambda[f(\delta, \theta) + \rho(\delta)y] + (1 - \lambda)y - 1. \quad (21)$$

²⁶ Since the model is single-period, in determining social welfare, we will not consider the potential negative externalities that may arise in the long term from the informal projects, but will focus solely on the short-term economic returns. However, if the informal project involves the cultivation of a drug crop, as in the example reported in the introduction, we acknowledge that this can have significant negative effects on society in the long run. For instance, drug production can exacerbate health issues, increasing the burden on public healthcare systems and lowering the quality of life for citizens. It can also raise crime and violence rates, reduce the effectiveness of institutions and public trust, as well as increase the economic burden of fighting crime. In a possible extension of the model to multiple periods, the government should set policies considering these long-term costs that significantly reduce social well-being.

²⁷ This approach may be in line with the growing empirical works on the estimation methods used to quantify the size of the informal economy and its potential contribution to societal well-being (Schneider & Buehn, 2018). However, in our framework, informal projects are still considered illegal or non-contractible; otherwise, they could be formalized into financial contracts, especially if the monetary rewards are large.

where in this case the solution, denoted by δ^{opt} , depends on the utility weight θ and, specifically, derives from the condition

$$f_{\delta}(\delta, \theta) + \rho'(\delta)y \leq 0, \quad (22)$$

that is from the difference between formal and informal project's marginal productivities. We thus need to distinguish between the two cases. (1) If the informal activity is relatively less productive than the formal investment, the welfare-maximizing diversion fraction is $\delta^{opt} = 0$, so that $\omega^{in}(0) = \omega^{FI}(0)$. (2) If diversion is relatively more productive, the solution to Eq. 21 implies $\delta^{opt} > 0$, meaning that it can be socially optimal to let D types invest in informal projects. Algebraically, the difference between welfare at δ^{opt} and full-information welfare is $\omega^{in}(\delta^{opt}) - \omega^{FI}(0) = \lambda f(\delta^{opt}, \theta) - \lambda[1 - \rho(\delta^{opt})]y$, which depends on the magnitude of informal returns. We thus have the following

Proposition 2 *When $f(\delta, \theta)$ is included in welfare and is particularly large, the optimal diversion fraction is $\delta^{opt} > 0$.*

Therefore, social efficiency would require the presence of entrepreneurs who engage in informal activities, even if illegal, and even if, in theory, they may end up being punished by the law. From the discussion above, optimal welfare is thus equal to full-information welfare if the proceeds from diversion are excluded or, if included, the productivity of informal projects is relatively low. But, when the informal project productivity is relatively high, we come to the surprising conclusion that welfare can be larger than under full information. We acknowledge that this implication, though valid within the framework of our theoretical model, is not easily generalizable and difficult to validate empirically.

4.1 Equilibrium welfare

In this subsection, we compare the socially efficient welfare solution with those derived in the three regimes derived in Sect. 3.

Full-diversion welfare In the full-diversion regime, $\delta(r_{\max}, \theta) = 1$. If the informal output produced by D types is excluded, social welfare is $\omega^{ex}(1) = (1 -$

$\lambda)y - 1$, lower than under full information and thus inefficient. If $f(1, \theta)$ is instead included, welfare is $\omega^{in}(1) = \lambda f(1, \theta) + (1 - \lambda)y - 1$. Since $\delta^{opt} \leq \delta(r_{\max}, \theta) = 1$, it follows that the equilibrium at $r_{\max}$ is socially inefficient even though the informal project is extremely productive. The difference between $\omega^{in}(1)$ and welfare under full information, $\omega^{FI}(0)$, is equal to $\omega^{in}(1) - \omega^{FI}(0) = \lambda f(1, \theta) - \lambda y$, which can be positive if $f(1, \theta) > y$.

Partial-diversion welfare In the partial-diversion equilibrium, if $f(\tilde{\delta}, \theta)$ is excluded, the welfare function is $\omega^{ex}(\tilde{\delta}) = [1 + \lambda\rho(\tilde{\delta}) - \lambda]y - 1$, which is strictly lower than $\omega^{FI}(0)$ as $\tilde{\delta} \in (0, 1)$, and thus inefficient. When $f(\tilde{\delta}, \theta)$ is included, welfare is $\omega^{in}(\tilde{\delta}) = \lambda f(\tilde{\delta}, \theta) + [1 + \lambda\rho(\tilde{\delta}) - \lambda]y - 1$, and the equilibrium fraction of loan diverted is such that the condition in Eq. 3 holds, that is $f_{\delta}(\tilde{\delta}, \theta) = -\rho'(\tilde{\delta})(y - \tilde{r})$. From the concavity of $f(\delta, \theta)$, it follows that $\tilde{\delta} > \delta^{opt}$, that is D entrepreneurs tend to divert too much compared to the efficient amount. The equilibrium at $\tilde{r}$ is therefore socially inefficient whether or not $f(\tilde{\delta}, \theta)$ is counted as social welfare.

No-diversion welfare . In this regime, if it exists, the diversion fraction is $\delta(r_{\min}, \theta) = 0$. Social welfare, therefore, does not depend on whether the output from diversion is included or not, and $\omega^{ex}(0) = \omega^{in}(0) = y - 1 = \omega^{FI}(0)$. The no-diversion equilibrium is socially efficient, and welfare is equal to the full-information level.

From the above analysis, if we exclude the possibility that $f(1, \theta) > y$, we come to the rather counterintuitive conclusion that the equilibrium is more likely to be efficient when there is a high proportion of potential diverters. That is, we can state the following:

Proposition 3 *The no-diversion equilibrium is socially efficient.*

Using the functional forms of the example in Sect. 3, the optimal diversion fraction, if the proceeds from the informal investment are included in welfare, derives from

$$\max_{\delta} \omega^{in}(\delta) = \lambda \frac{\theta}{2} [1 - (1 - \delta)^2] + (1 - \lambda\delta)y - 1,$$

yielding $\delta^{opt} = 1 - \frac{y}{\theta}$. Assuming $y < \theta$, $\omega^{in}(\delta^{opt}) = y + \frac{\lambda(\theta-y)^2}{2\theta} - 1 > y - 1 = \omega^{FI}(0)$, that is, optimal welfare is larger than under full information.

In the full-diversion regime, welfare is $\omega^{in}(1) = \lambda\theta/2 + (1-\lambda)y - 1$, lower than the optimal welfare, $\omega^{in}(\delta^{opt})$, whereas $\omega^{in}(1) - \omega^{FI}(0) = \lambda(\theta - 2y)/2$, positive if $\theta > 2y$, as depicted in Fig. 3a. Even if the proportion of funds diverted is above the socially efficient level, equilibrium welfare is larger than under full information for all $\lambda \in (0, \underline{\lambda}]$.

In the partial-diversion equilibrium, welfare when $f(\tilde{\delta}, \theta)$ is included is

$$\omega^{in}(\tilde{\delta}) = \frac{(2\lambda-1)\theta^2 + 3\lambda[2y\theta + \lambda(\theta-y)^2]}{8\lambda\theta} - 1,$$

which can be shown is lower than optimal welfare, $\omega^{in}(\delta^{opt})$, and thus inefficient. In addition, it can be shown that the difference between equilibrium welfare and full-information welfare can be positive for all $\lambda > \theta/3(\theta - y) \equiv \tilde{\lambda}$, where this threshold is smaller than 1 if $\theta > 3/2y$, and is equal to $\underline{\lambda}$ if $\theta = 2y$. For $\theta \geq 2y$, $\tilde{\lambda} < \underline{\lambda}$ and equilibrium welfare is higher than the full-information level in the interval $[\underline{\lambda}, 1)$. In the numerical case of Fig. 3b, if $y = 2$ and $\theta = 4$, $\omega^{in}(\tilde{\delta}) > \omega^{FI}(0)$ for all $\lambda \in (0.67, 1]$. If $\lambda = 0.8$, $\omega^{in}(\tilde{\delta}) - \omega^{FI}(0) = 0.175$.

4.2 Policy

In this subsection, starting from an inefficient market equilibrium, we show what would happen if a planner/government implements a policy to correct the mis-

allocation of credit resources. To restrict the discussion, we consider that the informal project's output is included in the measure of social welfare and is particularly valuable. If this is the case, the socially efficient welfare is $\omega^{in}(\delta^{opt})$, with optimal diversion fraction δ^{opt} . We follow the Kaldor-Hicks compensation principle, so the policy should be implemented only if the gains outweigh the losses. To be more specific, the lender's post-policy payoff must be (at least) equal to the pre-policy equilibrium profit, based on the (inefficient) equilibrium repayment. The difference between these two profit levels will correspond to the policy cost. The *gross* expected benefit of the policy is the difference between optimal and equilibrium welfare. Thus, the *net* expected benefit is the difference between the gross benefit and cost.

The optimal diversion fraction can be achieved, for example, by introducing an interest rate cap. If the informal investment returns are large, the reaction function of D borrowers in Eq. 3 corresponds to the condition in Eq. 22, evaluated at $r = 0$. At this repayment, the bank incurs a loss equal to $\pi_B(0) = -1$. In the following, we will derive the net benefit and policy cost in the two inefficient equilibria at $r_{\max}$ and $\tilde{r}$, that is, respectively, in the full-diversion and partial-diversion regime.

Full-diversion regime The difference between socially efficient and equilibrium welfare is $\omega^{in}(\delta^{opt}) - \omega^{in}(1) = \lambda\rho(\delta^{opt})y - \lambda[f(1, \theta) - f(\delta^{opt}, \theta)]$, where the expected policy benefit corresponds to the formal project output, produced with probability $\lambda\rho(\delta^{opt})$, less the net gain foregone from lower informal project investment. The policy cost is $\pi_B(r_{\max}) - \pi_B(0) =$

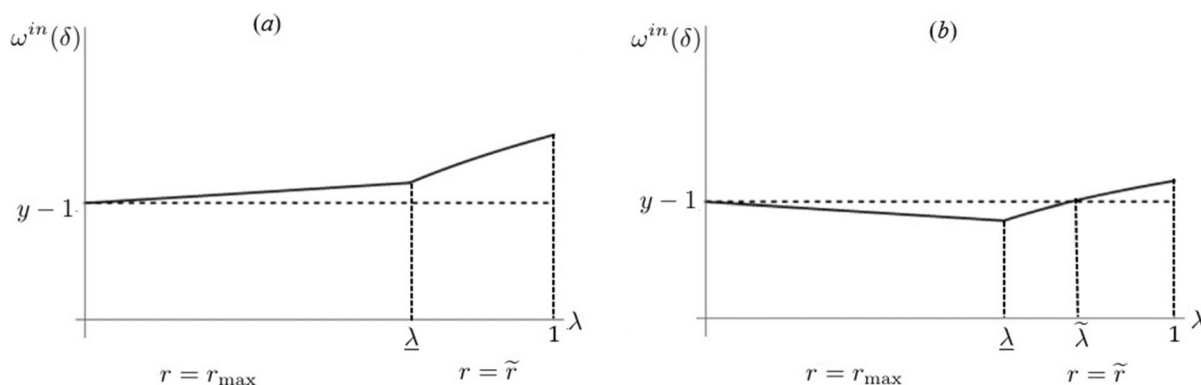


Fig. 3 Equilibrium and full-information welfare (diversion output included). Numerical example. **a** Parameters: $y = 2$; $\theta = 4.5$. **b** Parameters: $y = 2$; $\theta = 4$

$(1 - \lambda)y$. Hence, comparing policy gain and cost, we obtain

$$[\omega^{in}(\delta^{opt}) - \omega^{in}(1)] - [\pi_B(r_{\max}) - \pi_B(0)] = [\lambda + \lambda\rho(\delta^{opt}) - 1]y - \lambda[f(1, \theta) - f(\delta^{opt}, \theta)],$$

whose sign is ambiguous. For example, using the specific functions of the numerical example of Sect. 3, $\omega^{in}(\delta^{opt}) - \omega^{in}(1) = \lambda y^2/2\theta$, and the net policy gain is $[\lambda(1 + y/2\theta) - 1]y$, increasing in λ and equal to 0 when $\lambda = 2\theta/(y + 2\theta)$, which is above the threshold $\underline{\lambda}$. Thus, the net benefit is positive.

Partial-diversion regime The gross expected benefit of the policy is $\omega^{in}(\delta^{opt}) - \omega^{in}(\tilde{\delta}) = \lambda[\rho(\delta^{opt}) - \rho(\tilde{\delta})]y - \lambda[f(\tilde{\delta}, \theta) - f(\delta^{opt}, \theta)]$, where $\rho(\delta^{opt}) - \rho(\tilde{\delta})$ is positive as $\delta^{opt} < \tilde{\delta}$ and $\rho'(\delta) < 0$. The policy cost is $\pi_B(\tilde{r}) - \pi_B(0) = [1 + \lambda\rho(\tilde{\delta}) - \lambda]\tilde{r}$, while the net benefit of the policy is

$$[\omega^{in}(\delta^{opt}) - \omega^{in}(\tilde{\delta})] - [\pi_B(\tilde{r}) - \pi_B(0)] = \lambda[\rho(\delta^{opt})y - \rho(\tilde{\delta})(y + \tilde{r}) + f(\delta^{opt}, \theta) - f(\tilde{\delta}, \theta)] - (1 - \lambda)\tilde{r},$$

which is negative as the profitability of the informal project is assumed to be larger than that of the formal project. In our numerical example, $\omega_{in}(\delta^{opt}) - \omega_{in}(\tilde{\delta}) = [\lambda y + (1 - \lambda)\theta]^2/8\lambda\theta$, and the policy cost is $\pi_B(\tilde{r}) - \pi_B(0) = [\lambda y + (1 - \lambda)\theta]^2/4\lambda\theta$, yielding negative net benefits, $-[\lambda y + (1 - \lambda)\theta]^2/8\lambda\theta < 0$. In this scenario, a policy intervention would *not* lead to a welfare improvement.

Therefore, we can state the following

Proposition 4 *If the informal project output is included in welfare, a policy intervention may not be welfare-improving.*

When the informal activity is extremely productive and included in welfare, it might be better to let destructive entrepreneurs divert their loan funds and not intervene with a policy. The reason is simply that achieving the socially efficient diversion production would require a target repayment of zero on formal contracts, and this might be too costly to implement. Even though diversion results in destructive investment, the government can exploit the welfare gains achievable through the illicit but tolerated informal activities (of

course, leaving aside moral and ethical principles or other socio-economic concerns).

5 Conclusion

In this paper, we analyze the rent-seeking behavior of entrepreneurs and their strategic interaction with a lender in the presence of asymmetric information. Specifically, we consider a theoretical framework in which some borrowers can have the incentive to invest part of the business loan received for other, illegal or informal, and non-contractible activities. Our analysis yields two main results. The first is that the equilibrium is more likely to be efficient when there is a high proportion of potentially destructive entrepreneurs who can divert funds into informal investments. The reason is that this propensity forces the lender to reduce the loan repayment—which otherwise would be equal to the entire output produced—thus increasing the expected return of the formal investment. The second result is that, a regulatory intervention, in the form of an interest cap, can be welfare improving but, if the informal investment is highly profitable and its output included in the social welfare function, the rationale for public intervention may be weaker and the socially optimal fraction of loan diverted into informal activities can even be positive.

In the literature, informal sector participation has mainly been studied as a strategic response to excessive taxation and strict regulation, whereas here we examine the relationship between credit costs and informal investments through a model of loan diversion. In particular, we extend the literature on destructive entrepreneurship by focusing on the misallocation of business loan credit, rather than cash flows or business assets. Improper uses of borrowed funds can negatively affect the productivity of formal investments, thus increasing the risk of failure and reducing the potential for growth. The phenomenon of loan diversion is particularly prominent in contexts where access to credit is crucial for the long-term development of small business ventures. However, information asymmetries and high capital costs can increase the risk of credit misuse, especially in environments characterized by weak law enforcement, high default risk, and informational opacity, which are typical of small businesses.

We acknowledge that our findings depend on the quality of institutional and legal environments. The

decision to invest in illicit or informal activities is far more costly in contexts characterized by well-functioning institutions and effective law enforcement, where the profitability of the informal output is minimal. Conversely, in environments with poor law enforcement and ineffective governance, participation in the informal sector is less burdensome, and its contribution to social welfare can be significant. For example, some empirical evidence suggests that in settings with weak institutions and corrupt governments—like former socialist countries—informal activities are often perceived as normal or even necessary business practices (Aidis & Adachi, 2007; Johnson et al., 2000) and may also represent a viable solution to poverty and economic stagnation in poor countries (de Soto, 1989).

Beyond economic incentives and the quality of political institutions, social and moral values can also significantly influence the decisions to operate informally. Moral costs, such as feelings of guilt or shame, may outweigh the financial gains of illicit/informal activities, serving as powerful deterrents. Conversely, a lack of social cohesion and trust may provide self-serving justifications that encourage investments in the informal sector (Moore et al., 2012; Qin et al., 2022). In our theoretical framework, moral costs could diminish the return of the informal project, and while some individuals with weaker moral constraints might be tempted to engage in destructive activities, others with stronger moral principles would never “play against the rules.” Further research could investigate how including illegal activities into the social welfare function affects public trust in political institutions and thus the individual’s inclination to participate in the informal sector.

From a policy perspective, our results suggest that regulations should take into account the profitability and societal impact of informal investments to ensure that interventions enhance rather than hinder overall welfare. Future research could explore how policies that aim to reduce information asymmetry between borrowers and lenders—through penalty or tax/subsidy mechanisms—or those aimed at curbing the high cost of credit, could help mitigate destructive rent-seeking behaviors.

Appendix

Second-order condition of profit-maximizing diversion choice.

The second-order condition of $\pi_D(r)$ evaluated at $\delta(r, \theta)$ is

$$\frac{d^2\pi_D(r)}{d\delta^2} = f_{\delta\delta}(\delta, \theta) + \rho''(\delta)u(y - r) < 0,$$

where the sign follows from $f_{\delta\delta} < 0$ and $\rho''(\delta) \leq 0$.

Proof $d\tilde{r}/d\lambda < 0$.

From Eq. 13, we can derive $\delta_{rr}(r, \theta)$ and determine the sign as follows,

$$\delta_{rr}(r, \theta) = \frac{\rho'(\delta)\rho''(\delta)[u'(y-r)]^2 - \rho'(\delta)u''(y-r)[f_{\delta\delta}(\delta, \theta) + \rho''(\delta)u(y-r)]}{[f_{\delta\delta}(\delta, \theta) + \rho''(\delta)]^2} > 0.$$

The condition above indicates that the rate at which the distracted fraction of funds grows with the increase of r is itself increasing. $\square$

Proof of Lemma 3 We break the proof into three parts. In the following, we will refer to $\tilde{r}$ as $r(\lambda)$.

Existence. To prove the existence of the threshold $\underline{\lambda}$ such that $r(\underline{\lambda}) = r_{\max}$, we need first to show that $r_{\max}$ lies within the range $[r(0), r(1)]$. Given that $r(\lambda)$ is strictly decreasing in λ , it follows that $r(0) > r(1)$. Since $r_{\max}$ is the maximum repayment the bank can set for any $\lambda \in [0, 1]$, it thus belongs to the range $[r(0), r(1)]$. If the function $r(\lambda)$ is continuous on the closed interval $[0, 1]$, as implied by differentiability, then for any $r_{\max}$ between $r(0)$ and $r(1)$, there exists at least one value $\underline{\lambda} \in [0, 1]$ for which $r(\underline{\lambda}) = r_{\max}$.

$\underline{\lambda} > 0$. The bank profit at $r_{\max} = y$ and $\delta(r, \theta) = 1$ is $\pi_B(y) = (1 - \lambda)y - 1$, whereas evaluated at $r(\underline{\lambda}) = \tilde{r}$ and $\tilde{\delta} \in (0, 1)$, the bank’s profit is $\pi_B(\tilde{r}) = (1 + \lambda\rho(\tilde{\delta}) - \lambda)\tilde{r} - 1$. As λ tends to zero, that is if there is a high-quality of the pool of borrowers, $\pi_B(y) - \pi_B(\tilde{r}) = y - \tilde{r} > 0$. For any positive level of λ , the derivative of the difference between the two profit levels is

$$\frac{d[\pi_B(y) - \pi_B(\tilde{r})]}{d\lambda} = [1 - \rho(\tilde{\delta})]\tilde{r} - y < 0,$$

where the sign derives from $y > \tilde{r}$, whereas the effect of λ on $\tilde{r}$ cancels out from the envelope theorem. So, the difference $\pi_B(y) - \pi_B(\tilde{r})$ is positive for $\lambda = 0$ and decreases in λ and reaches zero when $r_{\max} = r(\underline{\lambda})$, that is $y = \tilde{r}$, and $\delta(\tilde{r}, \theta) = 1$ at $\lambda = \underline{\lambda}$.

Uniqueness. Consider a value $\lambda_1 \neq \underline{\lambda}$ such that $r(\lambda_1) = r_{\max}$. By monotonicity of $r(\lambda)$, if such a value exists, it must be equal to $\underline{\lambda}$. Thus, the threshold $\underline{\lambda}$ satisfying $r(\underline{\lambda}) = r_{\max}$ is unique. $\square$

Proof of Lemma 4 The proof of the existence and uniqueness of the threshold $\bar{\lambda}$ is similar to that of Lemma 3, with $r_{\min}$ being the minimum repayment the bank can set for any $\lambda \in [0, 1]$, given the incentive constraint of D entrepreneurs. $\square$

Proof of Lemma 5 Uniqueness. Suppose $\tilde{r}_1$ and $\tilde{r}_2$ are two solutions satisfying the first-order condition in Eq. 14 from the unconstrained maximization problem faced by the bank. Assume $\tilde{r}_1 > \tilde{r}_2$ for some $\lambda \in (0, 1)$. Condition in Eq. 15 establishes that $\tilde{r}$ is strictly decreasing in λ , implying that the inequality $\tilde{r}_1 > \tilde{r}_2$ cannot hold for the same value of λ . Therefore, there cannot exist two different solutions $\tilde{r}_1$ and $\tilde{r}_2$ for the same λ , proving the uniqueness of $\tilde{r}$.

Inequality. To establish the inequality $r_{\min} < \tilde{r} < r_{\max}$, we first show that $\tilde{r} > r_{\min}$ and then that $\tilde{r} < r_{\max}$. Suppose first, towards a contradiction, that $\tilde{r} < r_{\min}$. Given that the diversion fraction is increasing in r , a repayment lower than the no-diversion condition will still imply $\delta(\tilde{r}, \theta) = 0$. By monotonicity, the bank's profit function at $\tilde{r}$ would be lower than that at $r_{\min}$, that is $\pi_B(\tilde{r}) < \pi_B(r_{\min})$. Thus, the bank would have no incentive to set a repayment lower than $r_{\min}$. So, if an equilibrium at $\tilde{r}$ exists, this must be strictly larger than $r_{\min}$. Now, consider the second inequality and suppose, towards a contradiction, $\tilde{r} > r_{\max}$. In this case, $\delta(\tilde{r}, \theta) = 1$ but $\pi_P(\tilde{r}) < 0$. P types would not accept the debt contract as they would receive less than their outside option. So, if an equilibrium at $\tilde{r}$ exists, this must be strictly lower than $r_{\max}$. $\square$

Proof of Proposition 1 The parameter λ , describes the relative proportion of destructive types, reflecting the quality of the pool of borrowers financed. Such a proportion affects indirectly the utility of P and D entrepreneurs via the repayment, $\tilde{r} = r(\lambda)$, set by the bank. The effect of a change in λ on the payoff of P entrepreneurs is

$$\frac{d\pi_P(r)}{d\lambda} = \frac{d\pi_P(r)}{dr} \frac{d\tilde{r}}{d\lambda} = -u'(y - \tilde{r}) \frac{d\tilde{r}}{d\lambda} > 0,$$

where the sign follows from $d\tilde{r}/d\lambda < 0$.

Using the envelope theorem, the effect on δ of a variation of λ drops out, and the effect of λ on the

payoff of D types is

$$\begin{aligned} \frac{d\pi_D(r)}{d\lambda} &= \frac{d\pi_D(r)}{dr} \frac{d\tilde{r}}{d\lambda} + \underbrace{\frac{d\pi_D(r)}{d\delta}}_{=0} \frac{d\delta}{d\lambda} \\ &= -\rho(\tilde{\delta})u'(y - \tilde{r}) \frac{d\tilde{r}}{d\lambda} > 0, \end{aligned}$$

where the sign follows again from $d\tilde{r}/d\lambda < 0$. $\square$

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Declarations

Conflict of interest The author declares no competing interests.

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References

- Acs, Z., Boardman, M., & McNeely, C. (2013). The social value of productive entrepreneurship. *Small Business Economics*, 40, 785–796.
- Aidis, R., & Adachi, Y. (2007). Russia: Firm entry and survival barriers. *Economic Systems*, 31, 391–411.
- Akerlof, G. (1970). The market for lemons: Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84, 488–500.
- Armendáriz, B., & Szafarz, A. (2011). On mission drift in micro-finance institutions. In B. Armendáriz & M. Labie (Eds.),

- Handbook of microfinance*. London-Singapore: World Scientific Publishing.
- Balyuk, T. (2023). FinTech lending and bank credit access for consumers. *Management Science*, 69, 555–575.
- Banerjee, A. (2013). Microcredit under the microscope: What have we learned in the past two decades, and what do we need to know? *Annual Review of Economics*, 5, 487–519.
- Banerjee, T., Roy, M., Raychaudhuri, A., & Ghosh, C. (2015). What drives households to divert loans? A village level study. *Asia-Pacific Social Science Review*, 15, 33–55.
- Baumol, W. (1990). Entrepreneurship: Productive, unproductive, and destructive. *Journal of Political Economy*, 98, 893–921.
- Beck, T., & Demirgüç-Kunt, A. (2006). Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & Finance*, 30, 2931–2943.
- Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2004). Bank competition and access to finance: International evidence. *Journal of Money, Credit, and Banking*, 36, 627–648.
- Berg, T., Burg, V., Gombović, A., & Puri, M. (2020). On the rise of fintechs: Credit scoring using digital footprints. *Review of Financial Studies*, 33, 2845–2897.
- Berdiev, A., & Saunoris, J. (2016). Financial development and the shadow economy: A panel VAR analysis. *Economic Modelling*, 57, 197–207.
- Berger, A., & Udell, G. (2002). Small business credit availability and relationship lending: The importance of bank organisational structure. *Economic Journal*, 112, F32–F53.
- Blackburn, K., Bose, N., & Capasso, S. (2012). Tax evasion, the underground economy and financial development. *Journal of Economic Behavior & Organization*, 83, 243–253.
- Bilicka, K., & Raei, S. (2023). Output distortions and the choice of legal form of organization. *Economic Modelling*, 119, Article 106159.
- Bougheas, S. (2004). Internal vs external financing of R&D. *Small Business Economics*, 22, 11–17.
- Box, M., Gratzter, K., & Lin, X. (2020). Destructive entrepreneurship in the small business sector: Bankruptcy fraud in Sweden, 1830–2010. *Small Business Economics*, 54, 437–457.
- Burkart, M., & Ellingsen, T. (2004). In-kind finance: A theory of trade credit. *American Economic Review*, 94, 569–590.
- Capasso, S., Ohnsorge, F., & Yu, S. (2022). Informality and financial development: A literature review. *The Manchester School*, 90, 587–608.
- Caserta, M., Monteleone, S., & Reito, F. (2018). The trade-off between profitability and outreach in microfinance. *Economic Modelling*, 72, 31–41.
- Canh, N., & Thanh, S. (2020). Financial development and the shadow economy: A multi-dimensional analysis. *Economic Analysis and Policy*, 67, 37–54.
- Coco, G. (2000). On the use of collateral. *Journal of Economic Surveys*, 14, 191–214.
- Collins, J., McMullen, J., & Reutzel, C. (2016). Distributive justice, corruption, and entrepreneurial behavior. *Small Business Economics*, 47, 981–1006.
- Cull, R., Demirgüç-Kunt, A., & Morduch, J. (2007). Financial performance and outreach: A global analysis of lending MicroMFIs. *Economic Journal*, 117, F107–F133.
- Dabla-Norris, E., Gradstein, M., & Inchauste, G. (2008). What causes firms to hide output? The determinants of informality. *Journal of Development Economics*, 85, 1–27.
- De Angelis, L., de Blasio, G., & Rizzica, L. (2020). Lost in corruption. Evidence from EU funding to Southern Italy. *Italian Economic Journal*, 6, 355–377.
- De Sordi, J., dos Santos, A., de Azevedo, M., Jorge, C., & Hashimoto, M. (2022). Dark, down, and destructive side of entrepreneurship: Unveiling negative aspects of unsuccessful entrepreneurial action. *The International Journal of Management Education*, 20, 100659.
- de Meza, D., & Webb, D. (1987). Too much investment: A problem of asymmetric information. *Quarterly Journal of Economics*, 102, 281–292.
- de Quidt, J., Fetzter, T., & Ghatak, M. (2011). Microfinance, social capital, and for-profit lending. Working paper.
- de Soto, H. (1989). *The other path*. New York: Harper & Row.
- Dewatripont, M., & Maskin, E. (1990). Contract renegotiation in models of asymmetric information. *European Economic Review*, 34, 311–321.
- Dewatripont, M., & Maskin, E. (1995). Credit and efficiency in centralized and decentralized economies. *Review of Economic Studies*, 62, 541–555.
- Diamond, D. (2004). Presidential address, committing to commit: Short-term debt when enforcement is costly. *Journal of Finance*, 59, 1447–1479.
- Diamond, L. (2002). Elections without democracy: Thinking about hybrid regimes. *Journal of Democracy*, 13, 21–35.
- Distefano, R. (2024). Occupational choice and entrepreneurship: From necessity to opportunity. *Annals of Public and Cooperative Economics*, 95, 225–247.
- Dreher, A., & Schneider, F. (2010). Corruption and the shadow economy: An empirical analysis. *Public Choice*, 144, 215–238.
- Durnev, A., & Kim, H. (2005). To steal or not to steal: Firm attributes, legal environment, and valuation. *Journal of Finance*, 60, 1461–1493.
- Fredström, A., Peltonen, J., & Wincent, J. (2021). A country-level institutional perspective on entrepreneurship productivity: The effects of informal economy and regulation. *Journal of Business Venturing*, 36, Article 106002.
- Fuster, A., Goldsmith-Pinkham, P., Ramadorai, T., & Walther, A. (2022). Predictably unequal? The effects of machine learning on credit markets. *Journal of Finance*, 77, 5–47.
- Garikipati, S. (2013). Microcredit and women's empowerment: Have we been looking at the wrong indicators? *Oxford Development Studies*, 41, S53–S75.
- Gharleghi, B., & Jahanshahi, A. (2020). The shadow economy and sustainable development: The role of financial development. *Journal of Public Affairs*, 20,
- Guha, B., & Roy Chowdhury, P. (2013). Micro-finance competition: Motivated micro-lenders, double-dipping and default. *Journal of Development Economics*, 105, 86–102.
- Guo, J., & Hung, F. (2020). Tax evasion and financial development under asymmetric information in credit markets. *Journal of Development Economics*, 145, Article 102463.
- Howorth, C., & Moro, A. (2012). Trustworthiness and interest rates: An empirical study of Italian SMEs. *Small Business Economics*, 39, 161–177.

- Johnson, S., Kaufmann, D., McMillan, J., & Woodruff, C. (2000). Why do firms hide? Bribes and unofficial activity after communism. *Journal of Public Economics*, 76, 495–520.
- Kar, A., & Swain, R. (2014). Interest rates and financial performance of microfinance institutions: Recent global evidence. *European Journal of Development Research*, 66, 87–106.
- Koo, H., Huang, C., & Kan, K. (2012). Interlinked contracts: An empirical study. *Economica*, 79, 350–377.
- Kornai, J. (1979). Resource-constrained versus demand-constrained systems. *Econometrica*, 47, 801–819.
- La Porta, R., Lopez-de Silanes, F., Shleifer, A., & Vishny, R. (2002). Investor protection and corporate valuation. *Journal of Finance*, 57, 1147–1170.
- La Porta, R., & Shleifer, A. (2008). The unofficial economy and economic development. NBER working paper no. 14520. National Bureau of Economic Research, Cambridge, MA.
- Lauermann, S. (2012). Asymmetric information in bilateral trade and in markets: An inversion result. *Journal of Economic Theory*, 147, 1969–1997.
- Levine, R., & Rubinstein, Y. (2017). Smart and illicit: Who becomes an entrepreneur and do they earn more? *Quarterly Journal of Economics*, 132, 963–1018.
- Madajewicz, M. (2003). Does the credit contract matter? The impact of lending programs on poverty in Bangladesh. Working paper
- Madestam, A. (2014). Informal finance: A theory of moneylenders. *Journal of Development Economics*, 107, 157–174.
- Maskin, E., & Xu, C. (2001). Soft budget constraint theories: From centralization to the market. *Economics of Transition*, 9, 1–27.
- Minelli, E., & Modica, S. (2009). Credit market failures and policy. *Journal of Public Economic Theory*, 11, 363–382.
- Mungai, J., Maingi, J., & Sma, M. (2014). Loan repayment and sustainability of government funded micro-credit initiatives in Murang'a county, Kenya. *International Journal of Business and Social Science*, 5, 171–186.
- Navajas, S., Conning, J., & Gonzalez-Vega, C. (2003). Lending technologies, competition and consolidation in the market for microfinance in Bolivia. *Journal of International Development*, 15, 747–770.
- Omri, A. (2020). Formal versus informal entrepreneurship in emerging economies: The roles of governance and the financial sector. *Journal of Business Research*, 108, 277–290.
- Qin, X., Shepherd, D., Lin, D., Xie, S., Liang, X., & Lin, S. (2022). The dark side of entrepreneurs' creativity: Investigating how and when entrepreneurs' creativity increases the favorability of potential opportunities that harm nature. *Entrepreneurship Theory and Practice*, 46, 857–883.
- Repullo, R., & Suarez, J. (2000). Entrepreneurial moral hazard and bank monitoring: A model of the credit channel. *European Economic Review*, 44, 1931–1950.
- Sampson, S. (1988). "May you live only by your salary!": The unplanned economy in Eastern Europe. *Social Justice*, 15, 135–159.
- Schneider, F., & Buehn, A. (2018). Shadow economy: Estimation methods, problems, results and open questions. *Open Economics*, 1, 1–29.
- Schneider, F., & Enste, D. (2000). Shadow economies: Size, causes, and consequences. *Journal of Economic Literature*, 38, 77–114.
- Shepherd, D. (2019). Researching the dark side, downside, and destructive side of entrepreneurship: It is the compassionate thing to do! *Academy of Management Discoveries*, 5, 217–220.
- Shleifer, A., & Vishny, R. (1992). Pervasive shortages under socialism. *RAND Journal of Economics*, 23, 237–246.
- Shneyerov, A., & Wong, A. (2011). The role of private information in dynamic matching and bargaining: Can it be good for efficiency? *Economics Letters*, 112, 128–131.
- Stiglitz, J., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *American Economic Review*, 71, 393–410.
- Wyck, B. (2001). Group lending under dynamic incentives as a borrower discipline device. *Review of Development Economics*, 5, 406–420.

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