Impact investing and social financial contracts

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Abstract

This paper proposes a new reason for why we might observe financial contracts which seek to stimulate capital raising firms to deliver a social return alongside a financial return on investment. The presence of these social financial contracts is usually explained by referring to either investors with altruistic preferences or the presence of a direct link between corporate financial and corporate social performance. This paper however advances the idea that social financial contracts can emerge naturally as the solution to a credit constraint problem in a common agency moral hazard setting. The credit constraint problem appears because a third party agent wants to incentivize a capital raising entrepreneur to internalize a positive externality the latter might have on his project. To this end however, the third party may offer an incentive contract which interferes ex-post with the entrepreneur's incentives to work diligently on his own project. This may then prevent the entrepreneur from being financed through a standard financial contract, but the paper provides conditions under which he may still be financed through a social financial contract which ensures the positive externality is internalized at the time the entrepreneur's project is financed.

1 Introduction

1.1 Impact investing and social financial contracts

In recent years a relatively new development in finance has been gaining more traction. In particular, a growing number of investors strategically deploy their capital in established firms and start-up enterprises in order to further a social or environmental goal such as for instance improving employee working conditions, supporting local community projects or engaging in environmental or wildlife protection.

Often coined impact investors these investors actively seek to generate a social alongside a financial return on investment, with the latter ranging from below to above market rates depending on investor preferences. In order to secure their social return on investment, impact investors write financial contracts with clauses and incentive schemes which explicitly promote the delivery of a positive social or environmental

impact. These contracts can therefore be viewed as social financial contracts in that they deliver societal benefits which stretch beyond the economic value generated for the investor and the firm or entrepreneur being financed.

At this point however, very little is known about why we observe such social financial contracts in practice. That is, why do impact investors spend time and resources on delivering positive externalities on other members in society? The main goal of this paper is to advance a new micro theoretical explanation for why we observe these social financial contracts.

Before going into the theory of the model however, it is worthwhile to align thoughts on what is impact investing and shed some light on the general characteristics of the impact investment industry.

The global impact investing network, (GIIN) a not-for-profit organization dedicated to increasing the scale and effectiveness of impact investing, defines impact investing as follows:

Definition (Impact investing (GIIN))**.** *Investments made in companies or organisations with the intention to generate a measurable, beneficial social or environmental impact alongside financial return.*

Although impact investing is often categorized as a form of socially responsible investing, it distinguishes itself from traditional forms of socially responsible investing. In particular, impact investing moves beyond socially responsible investment screening which screens investment portfolios in order to prevent allocating resources to socially harmful or sinful firms. Impact investing also differs from social and environmental investor activism which mainly seeks to influence corporate policy through shareholder resolutions and proxy voting.

Instead, impact investors seek to invest in firms or enterprises with the potential to deliver a significant positive social or environmental contribution and use traditional tools and structures in finance to achieve this goal. A prominent example of impact investing for instance comes from social venture capital funds which often combine active monitoring and high powered incentives to ensure that their investments indeed live up to their social or environmental return potential.

Who is involved in impact investing? Impact investors can be distinguished along a variety of dimensions. For instance from an institutional perspective, impact investing is carried out by philanthropic foundations such as de Omidyar Network, financial institutions such as J.P. Morgan's social finance desk and high net worth individuals who can use the resources offered by RSF social finance to identify and select impact investment projects. A different institutional set-up is also often accompanied by a different focus in terms of whether financial or social return on investment is prioritized.

However, even within an institutional category impact investors differ in the priority they place on financial return. This can for instance be illustrated by looking at the investment objective of two social venture capital funds, Renewal2 and the EcoEnterprises fund. The former fund describes its investment

philosophy as follows:

"Renewal Funds is catalyzing an emerging asset class of social venture financing. Our model is to deliver above market returns by investing in businesses in Canada and the US that provide the finest sustainability solutions."

In Renewel2's investment philosophy, impact investing is identified as a new asset class with the potential to generate above market returns. The EcoEntreprises fund on the other hand describes its mission as:

"EcoEnterprises Fund provides growth capital to community-based sustainable companies to achieve scale – generating lasting results that help address the critical environmental and social challenges of our time. Because these companies are often too small, or in unconventional sectors eschewed by traditional financiers these businesses struggle to access expansion capital and hand-holding necessary for long-term success."

Though financial return undoubtedly matters for this fund as well, the emphasize lies more on delivering social return which is obtained by providing effective solutions to pressing social and environmental challenges.

Although investing for impact has recently grown in popularity and is expected to grow toward the future, it is at this point not clear what has sparked this spurge in interest from investors. Why do investors actively seek to promote social or environmental change through financial contracts? At least two main explanations have thus far been advanced in both the scientific and popular press:

First, at a least part of the recent interest in impact investing stems from investors who view it as a new asset class with the potential to deliver higher yields than traditional investment opportunities [1]. As argued by Porter and van der Linde (1995) and Porter and Kramer (2011), firms and investors need to move beyond the traditional view that business policies which focus on delivering societal benefits also harm profitability. Instead, providing innovative solutions to societal and environmental problems in a market context can increase the total value to be shared and deliver both societal benefits and enhance firm profitability.

Because impact investing often targets firms and enterprises which engage in significant process or business innovation in order to implement a desired social or environmental change, finance first impact investors believe they invest in companies that will have a competitive advantage relative to their industry peers in a world in which the ability to handle environmental and social tensions is increasingly becoming a key business success factor. Finance first impact investors can therefore be viewed as investors who contribute to implementing solutions to social or environmental problems as a side effect in their search for high yielding investment opportunities.

[1] O' Donohoe, Leijonhufvud, and Saltuk (2010)

In a 2013 survey carried out by GIIN and the J.P. Morgan social finance desk [2], 65 % of impact investors surveyed expected their investments to deliver at least market rates of return.

Secondly however, not all impact investors expect or seek to obtain market rates of return on their investments and instead prioritize on generating a social return on investment. A prime example of this class of impact investors are venture philanthropists who not even seek their initial principal investment to be returned. However, not all impact investors can afford to loose their principal investment and choose to invest for instance in social impact bonds which seek to return the principal investment plus a bonus if the social impact bond project succeeds.

According to the same GIIN J.P. Morgan survey, 23 % of impact investors expect a below market rate of return closer to market rates while % 12 expect a below market rate of return closer to capital preservation. Under the assumption that these impact investors act rationally, the survey results indicate that about a third of impact investors is willing to trade off financial return for social return.

1.2 This paper's view on social financial contracts

Although the above two explanations for impact investing likely have some validity, they do respectively rely on the assumption of a positive, or absence of a negative, relationship between financial and social performance and the assumption that at least a subsection of investors have altruistic motives in that they are willing to trade-off financial for social return on investment.

Because empirical evidence on the presence of a social financial return link is mixed and altruistic motives in society are limited, this paper seeks to advance a third reason for impact investing which does not rely on these two assumptions.

In particular, this paper seeks to advance the idea that social financial contracts can solve a credit constraint problem which may emerge in a common agency moral hazard economic environment. In what follows the key idea of the paper will be outlined by describing the common agency moral hazard set-up.

Consider an economic environment in which a penniless entrepreneur, the agent, seeks financing to start up a project which he initially owns. The entrepreneur can obtain financing from a financier, who will assume the role of the first principal in the model. In order to ensure that his project is financially sound however, that is generates a positive net present value, the entrepreneur needs to take a costly effort action. In the paper this effort action will be referred to as financial effort to distinguish it from a second effort action to be introduced below.

In addition, the financial effort action is assumed to be only privately observable by the entrepreneur, creating a moral hazard problem for the financing of the entrepreneur's project. In particular, if the

[2]For the online version of the survey: Perspectives on Progress: The impact investor survey, January 2013

financier assumes the entire investment cost of the project, it is not ex ante obvious that the entrepreneur would not prefer to laze about on the job and avoid to take the costly effort action. Therefore, the financier will only be willing to provide the necessary funding if the financial contract he writes with the entrepreneur puts in place the necessary incentives for the entrepreneur to work diligently on his project.

In addition to having discretion over the profitability of his own project, the entrepreneur is also assumed to be able to deliver a positive social impact. More precisely, the entrepreneur is assumed to be able to operate his project in such a way that it improves the profitability of the project or firm of a third party agent in the economy. In order to deliver this positive social impact however, the entrepreneur needs to take a costly effort action which will be referred to as externality effort. The name externality effort is meant to reflect the fact the positive social impact action only affects the profitability of the third party agent's project but not the profitability of the entrepreneur's project. If the entrepreneur takes the externality effort action, to an outside observer it would seem that the entrepreneur's project has a positive externality on the third party agent.

In the absence of altruistic preferences, it is clear that the entrepreneur will not choose to deliver the positive impact unless he is given explicit incentives. However, in a similar way as for financial effort, externality effort in the model is assumed to be only privately observable so that the provision of incentives will be subject to a moral hazard problem.

There are many ways to interpret the set-up in which the entrepreneur can have a positive impact on a third party agent. The following three examples for instance may help to put the set-up in a real life perspective

First, suppose the entrepreneur wants to start up a plant on a site next to a river and that the third party is a hotel owner located nearby. The entrepreneur needs the water for cooling and suppose in addition that the quality of the river is poor due to the activities of the previous owner of the site. Because the entrepreneur only needs the water for cooling however, the poor water quality does not affect his profitability. Suppose now that by spending some effort redesigning his plant, the entrepreneur can release water of a better quality that when it was pumped up. Then though it would not improve the profitability of his own project, it may boost the profitability of the hotel because its guests may now use the river for leisure activities.

Secondly, consider an example from the software industry. Suppose the entrepreneur is a talented programmer who wants to start up his own software company. Suppose the entrepreneur can use his programming skills to write a piece of software which may serve as a platform for other software applications, but which does not necessarily allow him to generate additional profit for his own business. The entrepreneur may then have a positive social impact by writing and releasing the software code as open

source code, allowing another third party entrepreneur to improve the IT platform of his business and generate additional profits.

Finally, an example in an educational setting. Suppose the entrepreneur is a school located in a community in which a local arts and crafts industry finds it difficult to find skilled, motivated young people who want to work in the arts and crafts business. The school may then have a positive social impact on the community by offering classes after regular school hours in which students can learn the skills necessary to work in the local arts and craft industry. Such classes may be too specific to form part of the school's regular curriculum, but in offering them after hours the school may still allow the businesses of the local arts and craft industry to have better access to skilled workers boosting their profitability.

In the above set-up a natural prediction to make is then that the financier will first attempt to finance the entrepreneur through a financial effort incentive compatible contract and that the third party will then seek to incentivize the entrepreneur through a separate contract which ensures that the entrepreneur also exerts externality effort and hence delivers the positive social impact.

The first prediction the paper makes however is that if the financier and the entrepreneur each non-cooperatively offer separate incentive contracts, the entrepreneur may not be able to obtain financing from the financier if the latter is restricted to using standard financial contracts to finance the entrepreneur's project. A standard financial contract in the paper will be defined as one which grants the entrepreneur a simple stake in the success of his own project. What the model will then show is that under certain conditions, the incentive contract offered by the third party may interfere with the incentives put in place by the financial contract and all together prevent the financier from writing a standard financial contract which ensures that the entrepreneur will exert financial effort.

As will be shown, the main reason for this is that after the financial contract has been put in place, the third party will have an incentive to collateralize the entrepreneur's stake in the success of his own project so as to reduce the cost of providing incentives for externality effort. This however will have the effect of reducing the entrepreneur's stake in the success of his own project and hence reduce his incentives for financial effort. The paper will first show that under certain conditions, the financier can not offer a stake to the entrepreneur which is collateralization proof and guarantees incentives for financial effort. If the entrepreneur is not financed then not only will the economic value of the entrepreneur's project be lost but also the value generated through the positive social impact.

The first conclusion of this paper should be put in perspective to the argument made in Coase (1960) which predicts that in a situation with production externalities the socially efficient outcome can often be achieved if the parties involved can freely bargain and this regardless of how initial property rights are divided. The Coase argument however assumes an absence of transaction costs and symmetric information

between the agents involved. Especially the last assumption breaks down in the model discussed in the current paper since externality effort is assumed to be unobservable to the third party agent. Previous papers such as Farrell (1987) have already indicated how the Coase argument may fail to hold in set-ups with asymmetric information and the current paper can be viewed as falling into this category.

The second prediction the paper will then make however is that if the financier is credit constrained under standard financial contracts, then under certain conditions he may obtain financing under a social financial contract which is a contract offered by the financier and which puts in place both incentives for financial and externality effort. If incentives for effort on both dimensions are in place, then the entrepreneur no longer needs to write a separate incentive contract which may collateralize cash flow streams stipulated in the financial contract. The social financial contract in a way pre-empts a contractual offering by the third party and allows the third party to enjoy the benefits of the positive impact action without having to write a costly incentive contract.

To be sure however, the above reasoning relies on a set of assumptions on the contracting environment. In particular, why focus on standard financial contracts in the first place? First note that in the absence of the financier being able to stipulate covenants in the financial contract, such standard financial contracts will be shown to be optimal in the set-up of the model to be detailed below. Briefly, in the absence of covenants the optimality of a standard financial contract will stem from assuming that all agents in the model are protected by limited liability, lack outside financial reserves and that the financial contract can not stipulate a non-pecuniary penalty conditional on the failure of the entrepreneur's project.

Nevertheless, given that the credit constraint problem is caused by the third party ex-post collateralizing the financial contract, the question begs why the financier can not simply include a covenant in the financial contract preventing the third party from offering a contract which collateralizes the financial contract?

A couple of points can be raised in reply to this. First, note that even if covenants can be written into the contract, they will remain dead letter unless they can be enforced in court. If non-pecuniary penalties for covenant violations are ruled out, then covenants can only be enforced by contractually stipulating financial penalties. However, throughout the paper it is assumed that the agents in the model are protected by limited liability and lack outside financial resources so that it will be impossible to enforce covenants through financial penalties.

Secondly, even if covenants were enforceable in court through non-pecuniary penalties then two general types of covenants can be distinguished. On the one hand, the financier could stipulate in a covenant that the entrepreneur is not allowed to contract with the third party at all. Such a simple covenant is easy to write but as will be shown in the model, it might then prevent the socially optimal outcome in which the positive social impact is delivered from being achieved. Because of this, the lawmaker might decide that

such covenants are illegal and hence can not be written.

On the other hand, the financier may be able to write a more detailed covenant which prevents the third party from collateralizing the cash flows from the financial contract. In this case the socially efficient outcome can be obtained, but such a financial contract could then itself then be interpreted as a type of social financial contract in that it ensures that the socially efficient outcome is obtained. The non-covenant type social financial contract on which this paper focusses should then be interpreted as one which may arise in a setting in which specific non-collateralization contracts are infeasible or not enforceable due to the lack of non-pecuniary penalties.

In the next section, the paper will be linked to the existing literature on corporate social responsibility and responsible investing and also to the literature on common agency with which the set-up shares some elements.

1.3 Related literature

1.3.1 Corporate social responsibility and socially responsible investing

To date, the finance literature has paid relatively little attention to impact investing or socially responsible investing in general. Much of the research that has been produced on the topic is empirical in nature and seeks to answer the question of whether there is a link between corporate social and corporate financial performance. In other words whether it pays to do good or whether it ends up being financially detrimental to firms and investors.

It might be useful in light of the scope of this paper to quickly browse the literature on this topic since impact investing is often justified because it is considered to be an alternative asset class with attractive investment opportunities. This paper on the other hand makes an argument for impact investing not related to its financial performance. Given that to date there is mixed empirical evidence for a link between impact investing and higher financial performance, the argument presented in this paper might therefore constitute an attractive alternative explanation.

There are two general methodologies which have been followed in the past to examine the relationship between corporate social and corporate financial performance. First, a series of event studies focusses mainly on the short run financial implications, i.e. abnormal returns, of responsible or irresponsible corporate behavior. These papers look primarily at stock price reactions following news related to a firm's corporate social performance, but yield mixed results on the relationship between social and financial performance.

For instance, papers such as Shane and Spicer (1983) , Hamilton (1995) , Klassen and McLaughlin (1996) and Karpoff, Lott, and Wehrly (2005) all document significant stock price reactions in response to news related to firms' environmental pollution record. However, Wright and Ferris (1997) found a negative relationship when looking at firms announcing support for the South African boycott in the 1980's. Finally, Teoh, Welch, and Wazzan (1999) finds no relationship between social and financial performance when looking at the financial implications of participating in the South Africa boycott.

A second set of papers seeks to examine the relationship between some measure of corporate social performance and long term financial performance. The latter is usually captured using accounting or financial measures of profitability. Similarly to the results from event study analyses, the results here are mixed as well. For instance, Aupperle, Carroll, and Hatfield (1985) found no relationship between a firm's social orientation and financial performance. Furthermore, McGuire, Sundgren, and Schneeweis (1988) found that past financial performance was more related to corporate social performance than future financial performance. This suggests a resource based rationale of corporate social responsibility in that wealthier firms tend to spend more on corporate social responsibility because they can afford to do so, rather

than that superior corporate social performance leads to better financial performance. A similar conclusion is reached by Moore (2001) after examining evidence from the UK supermarket industry. Waddock and Graves (1997) on the other hand do find a positive relationship between an index of corporate social performance and various financial performance measures such as ROA in the following year. Simpson and Kohers (2002) reaches a similar conclusion using data from the banking industry. Finally, Brammer and Millington (2008) finds that both firms with unusually poor and usually good corporate social performance have higher financial performance than other firms. Moreover, unusually poor corporate social performers tend to have superior financial performance in the short run while unusually good social performers exhibit superior financial performance in the longer run.

In light of the mixed empirical evidence on the link between social and financial performance, there appears to be a need for arguments which explain the observance of impact investing strategies without having to rely on assumptions regarding financial performance. The argument in this paper does not rely on such assumptions and is therefore advanced as an alternative explanation.

1.3.2 Common agency

From an economic theory perspective, the model in this paper can be considered to fall under the category of multi-principal agency problems also known as a common agency problems.

The first papers which explicitly recognized the importance of problems of common agency were Bernheim and Whinston (1985) and Bernheim and Whinston (1986) who extended the bilateral principal-agent model with moral hazard of Hölmstrom (1979) and Grossman and Hart (1983), to situations in which several principals independently influence a single agent.

Though previous papers such as Baron (1985) or Bernheim and Whinston (1985) already had multiple principals in their models, the set-ups were highly specialized and Bernheim and Whinston (1986) was the first paper who made an attempt at formalizing a general framework for problems of common agency.

In particular, Bernheim and Whinston (1986) considers a set-up in which a single agent can choose an action from an available set and where this action will affect the utility of the members of a group of principals. These principles however are assumed to have distinct preferences and hence disagree over what action the agent should take. Though the action choice itself is unobservable, the output it influences is not and the principals will seek to offer incentive contracts inducing the agent to take their most preferred action. The principals are assumed to move simultaneously and non-cooperatively in their contractual offerings and the agent takes the action which maximizes his utility after having aggregated the incentive schemes offered by the different principles.

Though the current paper shares with Bernheim and Whinston (1986) the idea of multiple principals

acting non-cooperatively, it differs in at least two ways.

First, the principals in the model offer their contracts sequentially rather than simultaneously. In particular, the financier who finances the project of the first entrepreneur acts as a Stackelberg leader and makes his contractual offering before the third party agent provides incentives for the socially desirable action. This is to reflect a natural situation in which a project or firm is first financed and started up after which other parties can then deal with the firm.

The consequence of this is that the third party agent will take the financing contract as given when he makes his contractual offering for the externality action. Moreover, since the third party agent is assumed to behave non-cooperatively, the paper will argue that his contractual offering may destroy the incentives put in place by the financial contract because he only partly internalizes the effects his contract has on the entrepreneur's incentives.

Baron (1985) is an applied paper who also uses a Stackelberg leader game set-up rather than a simultaneous move game.

Secondly, the two dimensions of actions over which the entrepreneur who seeks financing has control, each enter directly into the utility function of only one principal. In particular, only the financier cares directly about financial effort and only the third party agent cares directly about externality effort. In Bernheim and Whinston (1986) on the other hand, each action the agent can take affects the utility of all principals such that the paper can also be interpreted as falling under the category of papers dealing with contracting problems under externalities. A rather large literature starting with **?** discusses such situations in which a single contracting variable affects directly the utility of several principals. The more important externality problem in the current paper is the potentially negative externality the externality contract can have on the incentives put in place by the financial contract.

After Bernheim and Whinston (1986), the concept of common agency problems has been applied to a wide variety of problems most notably in the area of political economy. In particular, papers such as Grossman and Helpman (1994), Martimort (1996), Dixit, Grossman, and Helpman (1997), Martimort and Semenov (2008) have used a common agency set-up to model competition between interest or lobby groups in the political arena.

The current paper differs from this applied work however in that either the models assume symmetrical information or adverse selection type asymmetric information problems, rather than a problem of moral hazard on which the focus lies here.

Since the agent in the model has control over actions on two dimensions, the paper is also related to the multi-task principal agent model of Hölmstrom and Milgrom (1991). In that paper a single principal decides on how to construct an optimal incentive scheme when the agent has control over effort on several

task dimensions. The particular difficulty in such a situation is how to optimally provide incentives so that the agent does not overemphasize one task over another due for instance to the fact that effort on one task dimension is more easily measurable than on another or that effort on one dimension is less costly. Because a single principal however is in charge of the agent controlling multiple tasks, he will offer an optimal incentive scheme which ensures that the agent appropriately allocates his time to the different tasks. In the multi-principal set-up of this paper however, each principal has a direct interest in effort on a different dimension.

The novelty of this paper is then to show that one of the principals, in this case the financier, may be willing not only to incentivize the agent to work hard and ensure the financial success of his project but also to incentivize high effort on a socially beneficial action even though the effect of this action does not enter directly into the financier's utility function.

Finally, models of common agency have also been discussed in the finance literature. For instance Winton (1995) and Khalil, Martimort, and Parigi (2007) study costly state verification models in which multiple investors finance and monitor a single agent. The main focus of these papers is the analysis of equilibrium levels of monitoring and the role contractual design, such as seniority, plays in this regard. In the moral hazard model of the current paper, there is no active monitoring on behalf of the principals such that limited comparison with the results of these papers can be made.

2 Model

2.1 Model overview

Before diving into the details, this section first outlines the general set-up of the model.

The economy is a three stage game, populated by three agents: the financier, F, the entrepreneur, E, and the third party, TP. All agents in the model are assumed to be risk neutral and are protected by limited liability. The latter assumption will imply that all agents can only be made financially liable for resources which they own.

The entrepreneur, E, owns the idea to a project, P_1, which requires an upfront investment at the beginning of the game, $t = 0$, and which generates a random return at the end of the game $t = 3$. E is assumed to be penniless and therefore needs outside financing to make the upfront investment and start up his project. Financing for his project is available from the financier who has the necessary resources to fund P_1, but only P_1. In particular, after having made the initial investment in the entrepreneur's project, the financier is assumed to have depleted his financial resources. His wealth and future income then stem from the stake he has in P_1.

The third party, TP, owns the idea to a project, P_2, which is already fully funded and which also generates a random return at the end of the game $t = 3$. As was discussed in the introduction, the third party can be interpreted in many ways but for simplicity it is easiest to think of him as a second entrepreneur.

The entrepreneur, E, is assumed to have discretion over exerting effort on two different dimensions: working diligently on his own project, i.e. exerting financial effort, and delivering a positive social impact on the third party, i.e. exerting externality effort. Both effort types are assumed to be costly to the entrepreneur and only privately observable by him. This renders it far from certain at the onset whether the entrepreneur will choose to make effort on either one or both dimensions.

The financier, however, wants the entrepreneur to exert financial effort because it determines whether he can break even on his project or not. That is, P_1 will be positive net present value only if the entrepreneur makes financial effort. The third party on the other hand has no immediate interest in financial effort but wants the entrepreneur to deliver externality effort because it boosts the profitability of his project, P_2. The financier and the third party would therefore like to ensure that the entrepreneur is incentivized to deliver effort on the dimension in which each is respectively interested and they may seek to achieve this by writing contracts with the entrepreneur.

First, the financier has the opportunity to put in place incentives for financial effort through the financial contract which he writes at entrepreneur at time $t = 0$. This is the time at which the financier essentially

decides whether to provide funding for the initial investment and allow the entrepreneur to start up his project or not.

After the project has been financed and started up, the third party then has the opportunity to incentivize the entrepreneur to deliver a positive social impact. That is at time $t = 1$, the third party may offer the entrepreneur a contract which makes externality effort incentive compatible. Note however that the third party will not necessarily have to offer a separate externality contract. Indeed the main conclusion of the paper will be that in equilibrium externality effort may have to be incentivized through the financial contract, making it unnecessary for the third party to offer any additional contract.

Based on the aggregate incentives provided by the financial and externality contract, the entrepreneur then decides at time $t = 2$ whether or not he will exert financial and or externality effort. This will then determine the probabilities with which P_1 and P_2 succeed at the end of the game $t = 3$.

Note that the timing assumption implying that the entrepreneur and the financier first write the financial contract and the third party then secondly has the opportunity to offer an externality contract is meant to reflect a natural situation in which for practical reasons the third party can only contract with the entrepreneur until after P_1 has been financed and started up. This could be interpreted by assuming that the third party, which is in most cases is an outsider to P_1, does not know yet the potential of E to deliver a positive impact until after P_1 has taken concrete shape. The insiders, the financier and the entrepreneur, however can be expected to anticipate the fact that the third party may approach the entrepreneur to put in place incentives for externality effort if the financial contract has not already done so.

The following timeline 1 summarizes the above discussion and gives a quick overview of the model.

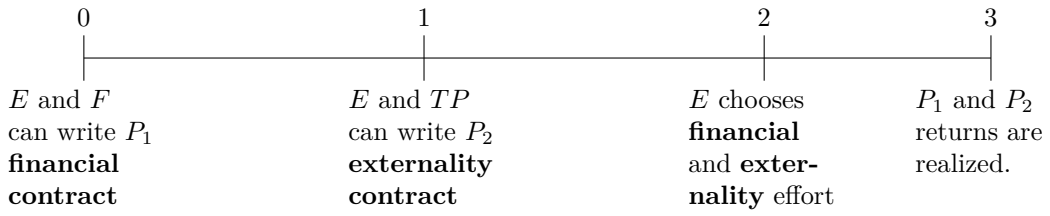

Figure 1: Timeline

2.2 Model set-up

In this section, the economic agents and the projects will be described in detail.

The penniless entrepreneur, E, owns a project P_1 which requires an investment I at time 0 and generates a binary random return $\widetilde{R}_1$ at time 3, the final stage of the game. With probability p_1, P_1 succeeds and $\widetilde{R}_1 = R_1$, while with probability $1 - p_1$, P_1 fails and $\widetilde{R}_1 = 0$.

$$\widetilde{R}_1 = \begin{cases} R_1 & \text{with prob.} \quad p_1 \\ 0 & \text{with prob.} \quad 1 - p_1 \end{cases} .$$

E has discretion over the probability with which P_1 succeeds through the effort action $e_a \in \{0, 1\}$. If E sets $e_a = 0$, he exerts no financial effort and P_1 succeeds with a base probability $p_1 = p_L$. If E sets $e_a = 1$, he makes financial effort and P_1 succeeds with a probability $p_1 = p_L + \Delta$, $\Delta > 0$.

$$p_1 = p_L + \Delta e_a,$$

where

$$0 < p_1 < 1.$$

Exerting financial effort is assumed to be costly to E in that he foregoes private benefits in the amount of B. These private benefits can be interpreted broadly as any utility benefits which the entrepreneur obtains when he does not work hard on the job or utility benefits he obtains when he implements his project in a way which leads to a lower success probability, but which is more fun to execute, delivers benefits to his friends, etc. .

P_1 is positive net present value only if E exerts effort and this even when taking account of the entrepreneur's private benefits. That is,

$$p_L R_1 + B < I$$

and

$$(p_L + \Delta) R_1 > I.$$

This assumption then also immediately implies that financial effort is socially desirable,

$$\Delta R_1 > B$$

.

Financial effort, e_a, is assumed to be unobservable to agents other than E and can not be contracted

upon. $\widetilde{R}_1$ on the other hand is observable and contractible. The financier may then attempt to overcome the moral hazard problem associated with financial effort by granting E a sufficiently stake in P_1.

In order to arrange thoughts on the moral hazard problem, it might be helpful to first consider a simplified setting in which only the entrepreneur and the financier are present. E is assumed to be protected by limited liability and is penniless. Therefore, the only resource he initially starts with is the idea to his project P_1. The financier, only has an amount I which he can invest in P_1 to allow E to start up his project.

Assuming the entrepreneur and the financier can not stipulate non-pecuniary penalties conditional on the outcome of the project P_1, the optimal financial contract will grant E a stake R^S, $0 \leq R^S \leq R_1$, when P_1 succeeds and nothing when P_1 fails. The financial contract will then make financial effort incentive compatible if R^S satisfies

$$(p_L + \Delta) R^S \geq p_L R^S + B$$

or

$$R^S \geq \frac{B}{\Delta}.$$

That is $\frac{B}{\Delta}$ is the smallest stake which will induce financial effort. E will then be able to obtain financing if the financier can at least break even under this minimum incentive compatible stake. That is if,

$$(p_L + \Delta)\left(R_1 - \frac{B}{\Delta}\right) \geq I.$$

Throughout the model, it will be assumed that the above condition holds and that E can receive financing in the absence of the third party, TP. Assumption 1 then serves as a benchmark which highlights how under a set of assumptions on the contracting environment the presence of TP, may render financing more difficult or even impossible.

Assumption 1. *The entrepreneur, E, can obtain financing from the financier in the absence of the third party, TP, that is,*

$$R_1 \geq \frac{B}{\Delta} + \frac{I}{p_L + \Delta}.$$

The third party, TP, owns a project P_2 which is fully funded at the beginning of the game and which generates a binary random return $\widetilde{R}_2$ at time 3. With probability p_2, P_2 succeeds and $\widetilde{R}_2 = R_2$, while with probability $1 - p_2$, P_2 fails and $\widetilde{R}_2 = R_2$.

$$\widetilde{R}_2 = \begin{cases} R_2 & \text{with prob.} \quad p_2 \\ 0 & \text{with prob.} \quad 1 - p_2 \end{cases}$$

In addition to having discretion over financial effort, e_a, E is assumed to have discretion over the probability with which P_2 succeeds through $e_b \in \{0, 1\}$. If E sets $e_b = 0$, he exerts no externality effort and P_2 succeeds with a base probability $p_2 = p_L$. If E sets $e_b = 1$, he exerts externality effort and P_2 succeeds with a probability $p_2 = p_L + \Delta$, $\Delta > 0$.

$$p_2 = p_L + \Delta e_b,$$

where

$$0 < p_2 < 1.$$

e_b is the positive social impact the entrepreneur can have through his project. Referring back to the examples in the introduction, $e_b = 1$ respectively captures efforts by E to redesign his plant to improve the water quality of the local river, time spent by E writing open source software code and time and resources spent by the school to organize an after hours arts and crafts class. $e_b = 0$ is then the flip side when the entrepreneur does not make any effort to deliver the positive social impact.

Similarly to financial effort, exerting externality effort is assumed to be costly to E in that he foregoes private benefits in the amount of B. These private benefits can be thought of as any utility benefits from not having to think through novel ways to use his project to deliver a positive social impact. [3]

Though externality effort boosts the profitability of TP's project, it is assumed not to be necessary for the viability of P_2. The third party will operate his project regardless of e_b. Referring back to the examples in the introduction, the hotel is profitable even if its guests can not use the river for leisure, other firms can still operate their businesses profitably without the open source software code and the local arts and craft industry can survive without the school's help. Nevertheless, like financial effort, externality effort is assumed to be socially desirable,

$$\Delta R_2 > B.$$

In a way similar to financial effort, externality effort, e_b, is assumed to be unobservable to agents other

[3] It should be noted that the model does not introduce heterogeneity in the parameters capturing the moral hazard problem for financial and externality effort. In particular, the private benefits of shirking on financial and externality effort are the same at B and effort increases the success probability of P_1 and P_2 by Δ. This assumption greatly simplifies the tractability and exposition of the paper and comes at little loss of generality even when discussing comparative statics results. An empirical analysis of the model, however, could easily incorporate heterogeneity in B and Δ because such a model could be solved numerically rather than analytically in closed form. Introducing heterogeneity in B and Δ might then be a worthwhile extension for future empirical research where it should come at little cost in terms of estimation.

than E. $\widetilde{R}_2$ on the other hand is publicly observable and hence contractible. Since setting $e_b = 1$ does not affect the profitability of P_2 but is privately costly, E will need explicit incentives to exert externality effort. If E has a sufficiently large stake in the success of P_2, he can be expected be incentivized to deliver the positive impact.

In order to put some further restrictions on the model parameters, it will be assumed that the third party would find it worthwhile to provide E with incentives for externality effort if he were restricted to using a contract which can only stipulate a stake in the success of P_2. That is such a contract can not stipulate a non-pecuniary reward or penalty conditional on the outcome of P_2, nor can it stipulate a financial penalty should P_2 fail. The inability of stipulating a financial penalty is what will be relaxed in what follows and will be shown to give rise to a credit constraint problem. Let r^S, $0 \leq r^S \leq R_2$ denote E's stake in the success of P_2. Then exerting externality effort is incentive compatible if

$$(p_L + \Delta)\, r^S \geq p_L r^S + B$$

or

$$r^S \geq \frac{B}{\Delta}.$$

TP will then find incentivizing E worth his while if he is better-off offering the incentive contract than by keeping with the default situation. That is if,

$$(p_L + \Delta)\left(R_2 - \frac{B}{\Delta}\right) \geq p_L R_2.$$

Assumption 2 captures this assumption which is held throughout the paper.

Assumption 2. *The third party, TP, can incentivize externality effort through a simple incentive contract which grants the entrepreneur, E, a stake in the success of P_2. That is,*

$$R_2 \geq \frac{(p_L + \Delta)}{\Delta}\frac{B}{\Delta}$$

Based on assumptions 1 and 2 it would seem at first that the socially efficient outcome in the model can be easily obtained. In particular, if E and the financier write a financial contract granting E a stake $R^S \geq \frac{B}{\Delta}$ in the success of P_1, while TP and E write an externality contract stipulating a stake $r^S \geq \frac{B}{\Delta}$ in the success of P_2, then the minimum incentive compatible stakes for financial and externality effort would be in place. The question now however is whether it can be expected that these contracts will indeed be the ones offered and written.

Suppose for the sake of argument that E and the financier first write a financial contract which stipulates

a stake $R^S \geq \frac{B}{\Delta}$. In other words, the financial contract puts in place incentives for financial effort through a simple stake in the success of P_1. In addition, suppose the third party can make a take it or leave it offer to the entrepreneur to incentivize externality effort. Then if the third party acts economically rational, he will seek to provide incentives in the cheapest way possible, while ensuring that the entrepreneur is willing to accept his contractual offer. In the absence of non-pecuniary penalties and rewards, the third party can then attempt to reduce the expected cost of the externality contract by shifting incentive provision from a reward, r^S, upon the success of P_2 to a penalty, r^F, upon P_2's failure.

Financial penalties however, can only be collected when the entrepreneur has financial resources available. Since E is assumed to be penniless and protected by limited liability, this implies that penalties can only be collected when the entrepreneur's project P_1 succeeds. But if E is potentially penalized when his project succeeds, then a penalty will effectively reduce the entrepreneur's stake in the success of his own project and reduce his incentives to exert financial effort. Then even though immediately after the financial contract has been written E might have incentives in place for financial effort, this may no longer be the case after the third party has offered his externality contract.

The first main task of the paper is to show that in response to a financial contract stipulating $R^S \geq \frac{B}{\Delta}$, the third party may offer an externality contract with penalties which the entrepreneur is willing to accept yet destroys his incentives for financial effort. Moreover, it will be shown that under certain conditions no stake $R^S \geq \frac{B}{\Delta}$ will exist which ex-ante ensures that the entrepreneur remains incentivized for financial effort after the third party's offer and which allows the financier to break even on his investment. The third party will be shown not to fully internalize the effects of his contractual offering. If the financier is then restricted to financial contracts which only allow for E to have a stake R^S in P_1's success, then the entrepreneur will effectively become credit constrained since the financier can not offer a contract which puts incentives in place and allows him to break even.

It should be noted that the above argument relies on the assumption that the third party has sufficient bargaining power to push for an externality contract with the lowest expected cost to him. In the paper this is modelled by assuming that the third party can make a take it or leave it (TIOLI) offer. Though this is an extreme form of shifting bargaining power to the third party, it is not crucial for the results of the paper but greatly simplifies the exposition of the paper.

In a real life situation, the source of the superior bargaining position of the third party agent can be viewed as coming from for instance local community support for the third party or social pressure which is put on the entrepreneur. In the following section, the assumption of the TIOLI offer and how it can be interpreted will be discussed in greater detail.

Before going into the solution of the model, it is worthwhile at this point to refer back to the introductory

arguments regarding the use of covenants in the financial contract. The above discussion makes it clear that the negative effect of the third party on incentives for financial effort stems from his ability to stipulate a penalty in the externality contract. In effect, such a penalty collateralizes the financial contract or the cash flows which it generates. Therefore, if the financier were to be able to stipulate in the financial contract that the third party may not collateralize the cash flow streams it generates, then the socially efficient outcome could be easily obtained by granting E a stake $R^S \geq \frac{B}{\Delta}$ in the success of P_1 and a stake $r^S \geq \frac{B}{\Delta}$ in the success of P_2.

Such a financial contract with covenant however could be interpreted as another form of a social financial contract because it ensures that the socially efficient outcome is obtained. Indeed, if it is possible for the financier to write a specific non-collateralization covenant, then it should be expected that a much easier covenant which prevents E from contracting with TP altogether is also possible [4]. Such a covenant would also solve the credit constraint problem and allow E to be financed but would be socially inefficient since absent altruistic preferences the positive impact action would not be delivered. Therefore to the extent that a perhaps more difficult to write non-collateralization covenant is used, it should equally be viewed as a non-traditional, social, financial contract. The social financial contract focussed upon in this paper however, assumes that covenants of the types just discussed are not feasible or illegal.

[4] Assuming the lawmaker has not legally stipulated which covenants can or can not be written.

2.3 Model solution

2.3.1 Financing under standard financial contract

In the following section it will first be shown how the credit constraint problem under standard financial contracts may arise. That is, if the financial contract is restricted to a stake R^S, $0 \leq R^S \leq R_1$, for E when his project, P_1, succeeds and a payment 0 when it fails, then under certain conditions, the entrepreneur can be credit constrained in the presence of the third party, TP.

Definition 1. *A standard financial contract between the entrepreneur, E, and the financier grants E a stake R^S, $0 \leq R^S \leq R_1$, in the success of P_1 and 0 in its failure.*

The standard financial contract is easily recognized as the financial contract that would be written between the financier and the entrepreneur in a set-up without the third party. Indeed, the optimal financial contract takes the form of a standard financial contract if the penniless entrepreneur protected by limited liability seeks to secure financing from the outside financier.

Apart from ruling out covenants, which were discussed at length in the previous sections, it should also be noted that the standard financial contract rules out two state contingent payment streams: first, it rules out a bonus payment for the entrepreneur when both P_1 and P_2 succeed and secondly, it rules out penalizing E when P_2 fails.

The use of a bonus payment contingent on the success of P_1 and P_2 is precisely what will give rise to the social financial contract which will be discussed at length in the last section of the paper. Indeed, the goal of the paper is to show that it may be necessary to use such a bonus payment in order to allow the entrepreneur to obtain financing from the financier.

The use of the penalty on the other hand is discussed in appendix A. There it is shown that through such a penalty the financier may prevent the credit constraint problem from arising. In particular, appendix A shows that if the financier stipulates a sufficiently large penalty in the financial contract, then he can make certain that the third party has no choice but to offer the entrepreneur an externality contract which respects the incentives for financial effort. Moreover, such a financial contract does not even have to stipulate a reward for the entrepreneur when P_1 succeeds, implying that E extracts negative rents from the financial contract, because the entrepreneur can expect to extract sufficient rents from his future dealing with the third party.

Such a financial contract however, can be viewed as holding the third party hostage and allows the entrepreneur and the financier to use their first mover advantage to excessively extract rents from the third party's project. Although the contract would lead to the socially efficient outcome, the lawmaker may likely prevent it from being written because allowing for the penalty may lead to an inequitable division

of the surplus generated by P_1 and P_2.

In addition, from a legal perspective it may also be technically hard to write such a financial contract because it essentially collateralizes the cash flow streams of a contract which is yet to be written. Indeed, in the limited liability set-up of the paper, the penalty can only be stipulated in expectation of the externality contract which the entrepreneur and the third party will write in the future. There might therefore be costs involved with such a contract which though it might be legal might make it infeasible. In light of this, the paper will therefore continue under the assumption that stipulating penalties in the financial contract is impossible or infeasible.

Assumption 3. *The payments stipulated in the externality contract can not be collateralized by the financial contract.*

After the financial contract has been written, the third party can choose to offer an externality contract to induce the entrepreneur to exert externality effort. Since the financial contract is in place, E is at that point entitled to a stake R^S if P_1 succeeds and the third party will take the financial contract into account when making his offer. Furthermore, in the paper it is assumed that the third party can make a take it or leave it (TIOLI) offer to the entrepreneur for an externality contract.

Assumption 4. *The third party agent, TP, can make a take it or leave it offer to the entrepreneur, E, for an externality contract.*

As was discussed in the introduction, the TIOLI assumption is meant to reflect a setting in which the third party has sufficient bargaining power to allow it to make a contractual offer which transfers as little rents to the entrepreneur as possible. The lower bound on the rents ultimately transferred is determined by the incentives which need to be provided and the fact that the entrepreneur needs to be left at least as well off. Although the TIOLI assumption may seem extreme, the results of the paper follow through if the third party has a smaller degree of bargaining power as well. Making the TIOLI assumption, however, greatly simplifies the exposition of the model.

The origin of the third party's bargaining power can stem from a variety of sources. For instance, the entrepreneur's local community or social network might sympathize with the third party's cause so that the entrepreneur prefers to avoid seeking high rent taking at the negotiation table. In addition, pressure groups such as NGO's or labour unions may back the cause of the third party and may be able to influence the public image of the entrepreneur through publicity campaigns or consumer labels. If the entrepreneur is then willing to accept terms which merely compensate him for his foregone private benefits or if he restricts himself to purely informational rents to overcome the moral hazard problem, then the NGO my reward the entrepreneur by enhancing his corporate reputation or societal legitimacy.

Under the TIOLI assumption, the third party can be expected to provide part of the incentives through a penalty conditional on P_2's failure, because this will allow him to lower the expected cost of the externality contract. The penalty however will be restricted to the stake which the entrepreneur has in P_1.

In particular the externality contract is assumed to be a pair $\left(r^S, r^F\right)$ where $0 \leq r^S \leq R_2$ is E's stake in the success of P_2 and $0 \leq r^F \leq R^S$ is a penalty E needs to pay TP when P_2 fails.

Definition 2. *An externality contract is a pair* $\left(r^S, r^F\right)$ *where* $0 \leq r^S \leq R_2$ *is E's stake in the success of* P_2*, while* $0 \leq r^F \leq R^S$ *is a penalty paid by* E *to* TP*.*

Two remarks should be made about the externality contract as it is defined. First, the limited liability assumption in the paper implies that the entrepreneur can only pay the penalty r^F when his project P_1 succeeds. Indeed, since E is penniless, his only source of income is his stake in his own project. The penalty however then effectively reduces E's success in the success of his own project and will reduce E's incentives to exert financial effort even though ample incentives may have been in place immediately after the financial contract has been written.

Secondly, the externality contract does not allow for a payment conditional on the success of P_1 and P_2. In appendix B, it is shown that allowing for a payment conditional on the success of P_1 and P_2 would resolve the credit constraint problem if P_2 is sufficiently profitable or if P_2 is not sufficiently profitable prevent the social financial contract from being a solution to the credit constraint problem. In order for the social financial contract to appear, it therefore needs to be assumed that the third party can not make use of such a more elaborate externality contract.

In reality however, it seems to some extent unrealistic that the third party would write an externality contract with such bonus. In particular, it would require not only require knowledge of his own project but also more elaborate knowledge of the entrepreneur's project. The writing costs of an externality contract with such a bonus might then prevent it from being feasible. Several papers in the finance and economics literature, such as Grossman and Hart (1986) and Hart and Moore (1988) have relied on writing or complexity costs to argue why contracts may have some contractual incompleteness. As such the paper will continue under the assumption that the externality contract does not contain a bonus payment conditional on the success of P_1 and P_2.

Assumption 5. *The externality contract can not stipulate a payment conditional on the success of both* P_1 *and* P_2*.*

The financier in the model is assumed to be perfectly rational and hence anticipates the future contracting opportunity between the entrepreneur and the third party. Moreover, the financier will only finance E's project if he is certain that in the end E will work diligently on his project and exert financial effort. This

implies that the financier will need to be able to write a financial contract which ensures that E continues to be motivated for financial effort after he has written the externality contract with the third party.

Under the standard financial contract restriction maintained in this section, the model solution below will show that the financier can enhance E's incentives for financial effort by granting him a larger stake R^S in P_1. The question is however whether a stake can be offered which is sufficiently high to maintain financial effort incentives post the externality contract and which still allows the financier to break even on his investment. If it is impossible for the financier to offer such a stake, then the financier will not be willing to finance the entrepreneur because he would certainly loose out on his investment. The entrepreneur will then be said to be credit constrained under standard financial contracts.

In order to derive the conditions under which the credit constraint problem arises, the model is solved through backward induction. First, as a function of R^S, the externality contract $\left(r^S, r^F\right)$ which the third party offers the entrepreneur is derived. Then as function of the expected externality contract that will be offered, it is determined when the financier can offer a stake R^S which ensures incentives for financial effort and allows him to break even.

Because effort choice in the model is binary, effort or no effort, the third party essentially has the choice between offering two types of externality contracts: first, he can offer the "social" externality contract which incentivizes externality effort while keeping incentives in place for E to exert financial effort and secondly, he can offer the "non-social" externality contract which incentivizes externality effort but does not lead to E being incentivized for financial effort.

Earlier in the paper it was argued that the prime cause for the potentially negative effect of the externality contract, stems from the third party wanting to provide incentives as cheaply as possible. It was suggested in particular that this leads TP to make excessive use of penalties rather than rewards. It might then be surprising at first that the non-social contract which puts less restrictions on the use of penalties is not necessarily the one TP will offer.

There are two reasons however why the non-social externality contract is not necessarily the cheapest. First, E is always free to accept or reject the take it or leave it offer from TP and will only accept if he is left at least as well off. Furthermore, a contract which destroys E's incentives for financial effort, also reduces the expected revenue he expects to extract from his project. In order to leave the entrepreneur at least as well off under the non-social contract, TP will then need to compensate E for the expected loss in utility resulting from his reduced incentives.

Secondly, the financial contract becomes more valuable as a source of collateral when it generates a positive cash flow more frequently. Though the non-social contract allows for a larger penalty and hence all else equal cheaper incentive provision, it also implies that P_1 will succeed less frequently. All else equal

this makes incentive provision more expensive since the penalty can be collected less frequently. To sum up though the non-social contract chews up more of R^S as a penalty, R^S is generated less frequently overall reducing the ability of the non-social contract to reduce the expected cost of incentive provision.

The social and non-social externality contracts TP may offer E each solve a constrained optimization program. First, the social externality contract solves the following program.

$$\min_{r^S, r^F \geq 0} (p_L + \Delta) r^S - (1 - (p_L + \Delta)) (p_L + \Delta) r^F$$

subject to

$$r^S - (1 - (2p_L + \Delta)) r^F \geq \frac{B}{\Delta} + \frac{B}{\Delta} - R^S \tag{IC_1^s}$$

$$r^F \leq \frac{1}{1 - (p_L + \Delta)} \left(R^S - \frac{B}{\Delta} \right) \tag{IC_2^s}$$

$$r^S + (p_L + \Delta) r^F \geq \frac{B}{\Delta} \tag{IC_3^s}$$

$$(p_L + \Delta) r^S - (1 - (p_L + \Delta)) (p_L + \Delta) r^F \geq B \tag{IR_1^s}$$

$$(p_L + \Delta) r^S - (1 - (p_L + \Delta)) (p_L + \Delta) r^F \leq \Delta R_2 \tag{IR_2^s}$$

$$r^S \leq R_2 \tag{LL_1^s}$$

$$r^F \leq R^S \tag{LL_2^s}$$

The social externality contract minimizes the expected cost to E of providing incentives for externality and financial effort. The constraints reflect the incentive compatibility, individual rationality and limited liability bounds the contract must satisfy.

In particular the three incentive compatibility constraints, IC_1^s, IC_2^s and IC_3^s, reflect the bounds such that E prefers to exert effort on both dimensions rather than, shirk on both dimensions, only exert effort on the externality dimension and only exert effort on the financial dimension.

Next, the individual rationality constraint IR_1^s ensures that E is at least as well off by accepting the contract rather than refusing it and IR_2^s ensures that TP finds it worthwhile to offer the social externality contract.

Finally, the limited liability constraints LL_1^s and LL_2^s ensure that TP can only reward E out of what P_2 generates and that TP can not penalize E over and above E's stake in P_1.

The constraints of the social externality contract immediately indicate that a social externality contract does not exist for $R^S < \frac{B}{\Delta}$. In particular, if $R^S < \frac{B}{\Delta}$, then the IC_2^s implies that $r^F < 0$ which is in violation with the fact that $r^F \geq 0$ because of limited liability.

Intuitively, when $R^S < \frac{B}{\Delta}$ then E is not incentivized to exert financial effort through the financial contract. When TP is restricted to using a contract which specifies a reward upon P_2's success and

a penalty upon P_1's failure however, he can not provide additional incentives for financial effort. The solution for the optimal social externality contract is therefore only defined for $R^S \geq \frac{B}{\Delta}$.

Next consider the non-social externality contract. When solving for the optimal non-social contract, a distinction has to be made between the case in which the financial contract puts in place incentives for financial effort, $R^S \geq \frac{B}{\Delta}$, and when it doesn't, $R^S < \frac{B}{\Delta}$. The reason for this is that the two cases imply different outside options for when E refuses the non-social externality contract and hence different individual rationality constraints.

In particular, if the financial contract does not provide incentives for financial effort, $R^S < \frac{B}{\Delta}$, E's expected utility when he refuses the externality incentive contract is

$$p_L R^S + B.$$

The individual rationality constraint for E in this case becomes

$$(p_L + \Delta)\, r^S - (1 - (p_L + \Delta))\, p_L r^F \geq B. \qquad (IR_1^{ns})$$

On the other hand, if the financial contract puts in place incentives for financial effort, $R^S \geq \frac{B}{\Delta}$, E's expected utility when he refuses the externality incentive contract is

$$(p_L + \Delta)\, R^S.$$

The individual rationality constraint for E in this case then becomes

$$(p_L + \Delta)\, r^S - (1 - (p_L + \Delta))\, p_L r^F \geq \Delta R^S. \qquad (IR_1^{ns'})$$

These two individual rationality constraints can now be used in the formulation of the optimization program for the non-social externality contract.

$$\min_{r^S, r^F \geq 0} (p_L + \Delta) r^S - (1 - (p_L + \Delta)) p_L r^F$$

subject to

$$r^S + p_L r^F \geq \frac{B}{\Delta} \qquad (IC_1^{ns})$$

$$r^S + r^F \geq R^S \qquad (IC_2^{ns})$$

$$r^F \geq \frac{1}{1 - (p_L + \Delta)} \left(R^S - \frac{B}{\Delta} \right) \qquad (IC_3^{ns})$$

$$(p_L + \Delta) r^S - (1 - (p_L + \Delta)) p_L r^F \geq B \qquad (IR_1^{ns})$$

$$(p_L + \Delta) r^S - (1 - (p_L + \Delta)) p_L r^F \geq \Delta R^S \qquad (IR_1^{ns'})$$

$$(p_L + \Delta) r^S - (1 - (p_L + \Delta)) p_L r^F \leq \Delta R_2 \qquad (IR_2^{ns})$$

$$r^S \leq R_2 \qquad (LL_1^{ns})$$

$$r^F \leq R^S \qquad (LL_2^{ns})$$

The incentive compatibility constraints, IC_1^{ns}, IC_2^{ns} and IC_3^{ns} ensure that E prefers to exert externality effort and shirk on financial effort over respectively, shirk on both effort dimensions, exert financial effort but shirk on externality effort and exert effort on both effort dimensions.

The IR_1^{ns} and $IR_1^{ns'}$ constraints ensure that E is willing to accept the non-social externality incentive contract respectively in the case in which $R^S < \frac{B}{\Delta}$ and $R^S \geq \frac{B}{\Delta}$.

IR_2^{ns} ensures that TP is willing to offer the externality contract and finally LL_1^{ns} and LL_2^{ns} are the limited liability constraints ensuring that TP does not reward beyond what is generated by P_2 and TP does not penalize over and above what E obtains from the financing contract.

By looking more closely at the constraints we can already see that in order for the $IR_1^{ns'}$ and IR_2^{ns} constraints to be compatible, we need to have that $R^S \leq R_2$ and that in order for the IC_3^{ns} and LL_2^{ns} constraints to be compatible we need that $R^S \leq \frac{1}{(p_L+\Delta)} \frac{B}{\Delta}$. In order for a non-social contract to exist we therefore need $R^S \leq \min \left\{ \frac{1}{(p_L+\Delta)} \frac{B}{\Delta}, R_2 \right\}$. This will be reflected in the solution of the optimal non-social contract below.

In order to determine whether TP will offer E the social or non-social externality contract, the above constrained optimization programs need to be solved and the expected cost of both types of contracts need to be determined. For a given R^S, TP will then make a take it or leave it offer for the contract with the lowest expected cost.

The expected cost of the optimal social externality contract as a function of R^S is given in proposition 1

Proposition 1. *The expected cost of the optimal social externality contract as a function of R^S is as follows.*

- *For $0 \leq R^S < \frac{B}{\Delta}$:*

There is no feasible social externality contract.

- *For $\frac{B}{\Delta} \leq R^S \leq \left(1 + \frac{(1-(p_L+\Delta))p_L}{(1-\Delta)(p_L+\Delta)}\right)\frac{B}{\Delta}$:*

$$(p_L + \Delta)\frac{B}{\Delta} - \frac{(p_L + \Delta)(1 - \Delta)}{1 - (p_L + \Delta)}\left(R^1 - \frac{B}{\Delta}\right).$$

- *For $\left(1 + \frac{(1-(p_L+\Delta))p_L}{(1-\Delta)(p_L+\Delta)}\right)\frac{B}{\Delta} < R^S$:*

$$B.$$

Proof. See technical appendix.[5] □

Proposition 1 tells us that R^S splits the optimal social externality contract into three regions. First, for $R^S < \frac{B}{\Delta}$, a social externality contract is not feasible because, as mentioned above, the incentive compatibility and limited liability constraints are incompatible.

Secondly, for $\frac{B}{\Delta} \leq R^S \leq \left(1 + \frac{(1-(p_L+\Delta))p_L}{(1-\Delta)(p_L+\Delta)}\right)\frac{B}{\Delta}$, we see that TP is unable to extract all economic rents when offering the incentive contract. This leaving E strictly better off than without the contract. Intuitively, when R^S is relatively low, TP is limited in his ability to provide incentives by penalizing E when P_2 fails. This is reflected in the fact that for this region of R^S the IC_2^s constraint binds indicating that for higher r^F, TP would destroy E's incentives for financial effort. The expected cost of the social externality contract in this region is given by

$$(p_L + \Delta)\frac{B}{\Delta} - \frac{(p_L + \Delta)(1 - \Delta)}{1 - (p_L + \Delta)}\left(R^S - \frac{B}{\Delta}\right).$$

Not surprisingly, the expected cost is decreasing in R^S since TP can make more use of penalties rather than rewards to incentivize E. The expected cost is also increasing in B, the private benefits E foregoes when he exerts effort.

[5]The technical appendix is available from the author by request.

Finally, for higher R^S, $\left(1+\frac{(1-(p_L+\Delta))p_L}{(1-\Delta)(p_L+\Delta)}\right)\frac{B}{\Delta} < R^S$, TP is able to provide incentives without leaving additional rents for E. E is then left equally well off after accepting the externality contract in that the expected cost of the incentive contract equals E's private benefits of shirking on externality effort, B.

Next, the expected cost of the non-social externality contract is given in proposition 2.

Proposition 2. *The expected cost of the optimal non-social externality contract as a function of R^S is given as follows:*

- *For* $0 \leq R^S < \frac{B}{\Delta}$*:*

$$(p_L + \Delta)\frac{B}{\Delta} - p_L R^S.$$

- *For* $\frac{B}{\Delta} \leq R^S \leq \min\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, R_2\right\}$*:*

$$\Delta R^S.$$

- *For* $\min\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, R_2\right\} < R^S$*:*

There is no feasible non-social externality contract.

Proof. See technical appendix. □

Proposition 2 first reveals that there is a non-monotonic relationship in the expected cost of the non-social contract. This non-monotonicity is a direct consequence of the binary nature of incentives in the model and in particular of whether the financial contract puts in place incentives for financial effort or not.

In particular, for $0 \leq R^S < \frac{B}{\Delta}$, the expected cost of the non-social externality contract is decreasing in R^S. This is because over this range TP can make more use of penalties to incentivize E, while at the same time TP does not have to compensate E for not being motivated anymore to exert financial effort since he was not motivated in the first place.

For larger R^S, TP can still make more use of penalties but now he will also have to compensate E for the loss in incentives for financial effort. This compensation is equal to the difference in P_1's success probability under financial effort times the compensation received when P_1 succeeds.

For $\frac{B}{\Delta} \leq R^S \leq \min\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, R_2\right\}$, TP can offer an incentive compatible contract which precisely compensates E for shirking on financial effort. That is, the $IR_1^{ns'}$ constraint binds. Of course, since the expected loss to E due to reduced incentives is increasing in his stake in P_1, the cost of this compensation and hence the expected cost of the non-social externality contract will be increasing in R^S.

For $\min\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, R_2\right\} < R^S$, TP can no longer offer the non-social externality contract since respectively the $IR_1^{ns'}$ and IR_2^{ns} and the IC_3^{ns} and LL_2^{ns} constraints contradict each other.

The results of propositions 1 and 2 are illustrated in figure 2.

[6]

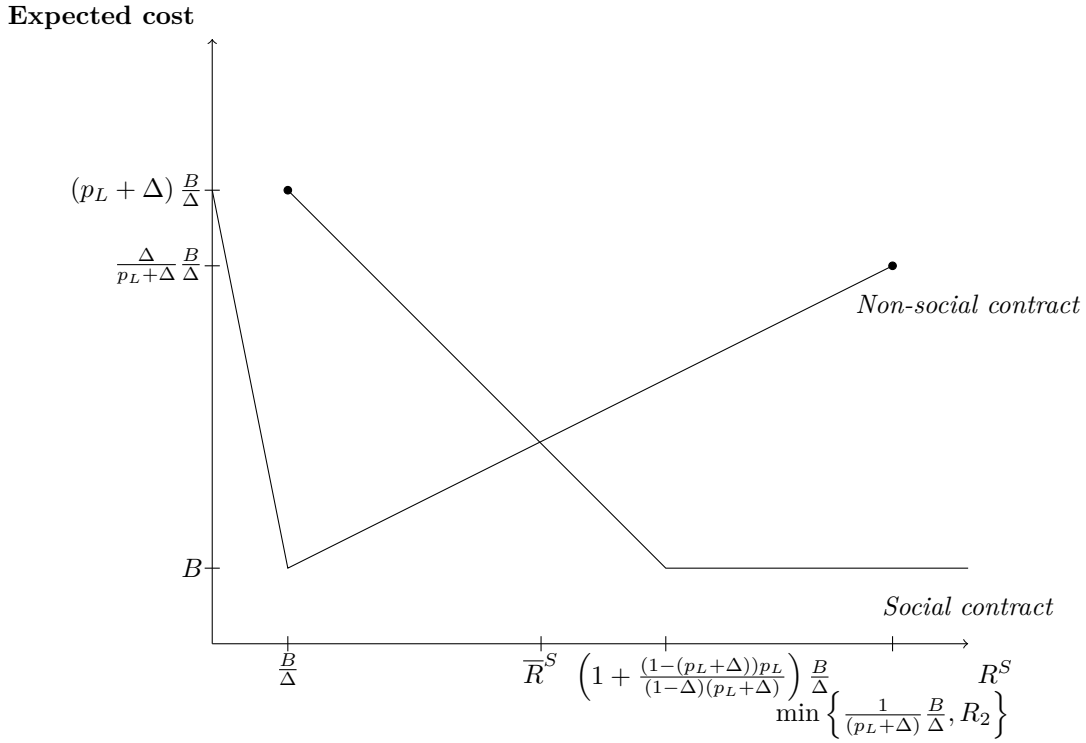

Figure 2: Social and non-social externality contract

[6]Note that the following holds:

$$\max\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, \frac{(p_L+\Delta)}{\Delta}\frac{B}{\Delta}\right\} > \left(1+\frac{(1-(p_L+\Delta))\,p_L}{(1-\Delta)\,(p_L+\Delta)}\right)\frac{B}{\Delta}$$

if $1 > p_L + \Delta$.

The last inequality holds by assumption since P_1 would otherwise be allowed to succeed with certainty.

Figure 2 and propositions 1 and 2 indicate that for $R^S < \frac{B}{\Delta}$ TP can only incentivize E through the non-social externality contract while for $R^S > \max\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, \frac{(p_L+\Delta)}{\Delta}\frac{B}{\Delta}\right\}$ only the social contract is available. For $\frac{B}{\Delta} \leq R^S \leq \max\left\{\frac{1}{(p_L+\Delta)}\frac{B}{\Delta}, \frac{(p_L+\Delta)}{\Delta}\frac{B}{\Delta}\right\}$ on the other hand, TP has the choice to incentivize E either through the social or through the non-social externality contract. Since TP is assumed to be a rational non-altruistic agent, he will choose the cheapest of the two incentive contracts to incentivize E.

TP will make a take it or leave it offer for the non-social externality contract if the expected cost of the social externality contract exceeds that of the non-social externality contract. That is if,

$$\begin{aligned}
\Delta R^S &< (p_L + \Delta)\frac{B}{\Delta} - \frac{(p_L + \Delta)(1 - \Delta)}{1 - (p_L + \Delta)}\left(R^S - \frac{B}{\Delta}\right) \\
\Leftrightarrow R^S &< \overline{R}^S \equiv \left(1 + \frac{(1 - (p_L + \Delta))\, p_L}{(1 - \Delta)(p_L + \Delta) + \Delta(1 - (p_L + \Delta))}\right)\frac{B}{\Delta}.
\end{aligned}$$

Clearly we have that,

$$\overline{R}^S < \left(1 + \frac{(1 - (p_L + \Delta))\, p_L}{(1 - \Delta)(p_L + \Delta)}\right)\frac{B}{\Delta}.$$

In other words, the region of R^S over which TP prefers the non-social contract is a subsection of the region over which the social contract does not break even.

In summary we then have that for $0 \leq R^S < \overline{R}^S$, TP will provide E with incentives to exert externality effort through the non-social externality contract, while for $\overline{R}^S \leq R^S$, TP will incentivize E through the social externality contract.

This is summarized in proposition 3

Proposition 3. *There exists a* $\overline{R}^S > \frac{B}{\Delta}$ *such that for*

$$0 \leq R^S < \overline{R}^S,$$

the third party, TP*, offers the non-social externality contract to incentivize externality effort, while for*

$$\overline{R}^S \leq R^S,$$

the third party, TP*, offers the social externality contract to incentivize externality effort.*
$\overline{R}^S$ *is given by*

$$\left(1 + \frac{(1 - (p_L + \Delta))\, p_L}{(1 - \Delta)\,(p_L + \Delta) + \Delta\,(1 - (p_L + \Delta))}\right) \frac{B}{\Delta}.$$

The conclusion of proposition 3 is that if the financier is restricted to financing the entrepreneur through a standard financial contract, he needs to offer him a stake R^S in P_1 which exceeds $\overline{R}^S$. Moreover, it can be easily observed that $\overline{R}^S > \frac{B}{\Delta}$ so that the financier needs to grant the entrepreneur a larger stake in P_1 compared to the situation in which the third party were not present to offer an externality contract.

This may result in the entrepreneur to be credit constrained in the presence of the third party even though it was assumed that he could obtain financing if TP were absent. That is not all projects may be profitable enough to allow the financier to break even on his investment after having granted the minimal incentive compatible stake of $\overline{R}^S$.

Corollary 1 gives the condition under which the entrepreneur can be credit constrained when the financier has to finance P_1 through a standard financial contract.

Corollary 1. *The entrepreneur,* E*, is credit constrained under standard financial contracts if*

$$(p_L + \Delta)\left(R_1 - \overline{R}^S\right) < I.$$

2.3.2 Financing under a social financial contract

Characterizing the social financial contract The previous section showed that despite the fact that the entrepreneur, E, can obtain financing for P_1 in the absence of the third party, TP, he can become credit constrained in his presence when the financier is restricted to using a standard financial contract. This section will now show how under certain conditions, the credit constraint problem can be resolved if the financier finances E through a contract which provides incentives for both financial and externality effort.

In the model this alternative financing contract will be called a social financial contract and it represents financial contracts which make financing conditional on the entrepreneur operating his project in a responsible way. Various forms of impact investing or socially responsible investing can be interpreted in this way, since all these investment options have in common that they seek not only to generate a financial return but also ensure that the project financed is operated in a responsible way. Translated into an economic vocabulary, the goal of these contracts is to make entrepreneurs internalize the externalities their operations might have on other agents in the economy.

For the model in this paper, this means that the social financial contract will provide explicit incentives to E to exert externality effort at the time P_1 is financed. The social financial contract will then differ from the standard financial contract in that it allows for a bonus conditional on the success of P_1 and P_2 and allows the financier to provide incentives for externality effort alongside financial effort.

There are potentially several social financial contracts which may resolve the credit constraint problem and these differ primarily in the extent to which incentives for externality effort are provided entirely through the social financial contract or in part through a separate externality contract offered by the third party.

To simplify the exposition in the following section however, this paper will focus on a situation in which the financier provides all incentives for externality effort through the social financial contract. The third party will then no longer need to offer an externality contract which may distort E's incentives for financial effort. In fact, the third party will benefit from the externality effort exerted by the entrepreneur without having to make out of pocket expenses. [7]

This is also what makes the social financial contract in this paper resemble real life examples of impact

[7] It should be noted that the social financial contract focussed on in this paper is the one most beneficial to the third party. Indeed, the third party benefits from an increased profitability of his project without him having to compensate the entrepreneur. Other social financial contracts would also achieve the social optimum but generate a different distribution of the total surplus since the third party would be required to make an additional transfer to the entrepreneur. If impact investors however have discretion over the type of social financial contract to offer, it is reasonable to assume that they will favor the third party and avoid him having to make these additional transfers. In particular, if impact investors behave competitively in pricing their financial contracts, then they will be financially indifferent between the different social financial contracts since these will all break even. However, it is likely that they will not be indifferent as to how the surplus of the contract is distributed between the entrepreneur and the third party and have a preference for those social financial contracts which favor the third party.

investing in that impact investing usually constitutes a dealing between investors and the entrepreneur raising capital. The third party agents benefitting from the entrepreneur's responsible behavior usually do not get involved in the provision of incentives for responsible behavior.

It is important to reiterate at this point that the only difference between the standard and social financial contract is the availability of a bonus conditional on the success of both P_1 and P_2. In particular, the financier is assumed to be subject to the same limited liability constraints and all transfers from the financier to the entrepreneur need to be payable out of P_1 alone.

The social financial contract is defined as follows. First, it stipulates a stake $\mathcal{R}^S$ for E when P_1 succeeds where $\mathcal{R}^S$ is bounded below by 0 and above by R_1. In addition, the social financial contract stipulates a bonus $\mathcal{R}^{2S}$ for E bounded below by 0 and above by $R_1 - \mathcal{R}^S$, to be paid when both P_1 and P_2 succeed. This is summarized in definition 3.

Definition 3. *A social financial contract is a pair* $\left(\mathcal{R}^{2S}, \mathcal{R}^S\right)$*, where* $\mathcal{R}^S$*,* $0 \leq \mathcal{R}^S \leq R_1$ *is a payment* E *receives conditional on the success of* P_1 *and where* $\mathcal{R}^{2S}$*,* $0 \leq \mathcal{R}^S + \mathcal{R}^{2S} \leq R_1$ *is a bonus* E *receives conditional on the success of* P_1 *and* P_2*.*

The argument showing how a social financial contract can emerge in equilibrium as the solution to the credit constrained problem described above, will proceed in two steps:

First, as a function of the model parameters, the cheapest contract incentivizing both financial and externality effort and satisfying the limited liability constraints will be derived. Cheapest here is viewed from the perspective of the financier and therefore refers to the incentive compatible contract implying he lowest expected payment to E. If the financier can break even under the cheapest social financial contract, then it is feasible for E to obtain financing.

Secondly, if there is a parameter configuration for which E is credit constraint under a standard financial contract but which allows financing under a social financial contract, then the social financial contract will be said to emerge naturally as a potential solution to the credit constraint problem. In particular, from the previous section we know that if the following condition holds

$$R_1 < \frac{I}{p_L + \Delta} + \left(1 + \frac{\left(1 - \left(p_L + \Delta\right)\right) p_L}{\left(1 - \Delta\right)\left(p_L + \Delta\right) + \Delta\left(1 - \left(p_L + \Delta\right)\right)}\right) \frac{B}{\Delta},$$

then E can not obtain financing under a standard financial contract. However, if for a parameter configuration satisfying the above condition there exists a feasible social financial contract, then it will be said that the social financial contract can solve the credit constraint problem.

In order to identify the cheapest feasible social financial contract, the following constrained optimization program needs to be solved.

$$\min_{\mathcal{R}^{2s},\mathcal{R}^{S}\geq 0}\left(p_L+\Delta\right)\left(p_L+\Delta\right)\left(\mathcal{R}^{2S}+\mathcal{R}^{S}\right)+\left(p_L+\Delta\right)\left(1-\left(p_L+\Delta\right)\right)\mathcal{R}^{S}$$

subject to

$$\left(2p_L+\Delta\right)\mathcal{R}^{2S}+\mathcal{R}^{S}\geq\frac{B}{\Delta}+\frac{B}{\Delta} \tag{IC_1^{sf}}$$

$$\left(p_L+\Delta\right)\mathcal{R}^{2S}+\mathcal{R}^{S}\geq\frac{B}{\Delta} \tag{IC_2^{sf}}$$

$$\left(p_L+\Delta\right)\mathcal{R}^{2S}\geq\frac{B}{\Delta} \tag{IC_3^{sf}}$$

$$\left(p_L+\Delta\right)\left(p_L+\Delta\right)\mathcal{R}^{2S}+\left(p_L+\Delta\right)\mathcal{R}^{S}\leq\left(p_L+\Delta\right)R_1-I \tag{IR_1^{sf}}$$

$$\left(p_L+\Delta\right)\left(p_L+\Delta\right)\mathcal{R}^{2S}+\left(p_L+\Delta\right)\mathcal{R}^{S}\geq 2B \tag{IR_1^{sf}}$$

$$\mathcal{R}^{2S}+\mathcal{R}^{S}\leq R_1 \tag{LL_1^{sf}}$$

$$\mathcal{R}^{S}\leq R_1 \tag{LL_2^{sf}}$$

The first thing to note is that in order for there to be a solution to the above optimization program, we need the following assumption on the parameters of the model

Assumption 6.

$$R_1\geq\frac{I}{p_L+\Delta}+\frac{2\left(p_L+\Delta\right)}{2p_L+\Delta}\frac{B}{\Delta}.$$

If 6 is violated, then the IC_1^{sf} and IR_1^{sf} constraints contradict each other and there doesn't exist a contract $\left(\mathcal{R}^{2S},\mathcal{R}^{S}\right)$ which satisfies the social financial contract constraint set. Intuitively, if R_1 is too low, then P_1 does not generate sufficient revenues to allow the financier to break even after having incentivized E through positive stakes in the cash flow generated by P_1.

Secondly, the solution to the optimization program turns out to depend on wether R_1 is larger than or smaller than $\frac{1}{p_L+\frac{\Delta}{2}}$. If R_1 exceeds $\frac{1}{p_L+\frac{\Delta}{2}}$, then incentives for high financial and high externality effort can be provided through a contract which only rewards E_1 when both projects succeed.

If R_1 is strictly less than $\frac{1}{p_L+\frac{\Delta}{2}}$ however, then the financier has to see whether he can provide incentives through a contract specifying both a non-negative payment $\mathcal{R}^{S}$ and bonus $\mathcal{R}^{2S}$.

Intuitively, since the ultimate goal is to incentivize effort on both dimensions, the strongest incentives will be provided through a contract stipulating a non-zero payment only when both P_1 and P_2 succeed. However, if all incentives are provided through a reward in a single state, the payment in this state, $\mathcal{R}^{2S}$, needs to be relatively high in order to satisfy the individual rationality constraints and P_1 may not generate

sufficient resources to allow for such high-powered incentive payment. In this case, part of the incentives need to be provided through a non-negative payment when P_1 alone succeeds.

When R_1 becomes too low however, even a social financial with a non-negative payment $\mathcal{R}^S$ will not be feasible and the financier will not be able to finance P_1 through a contract incentivizing high effort on both the financial and externality dimension.

The cheapest feasible social financial contract and its expected cost as a function of R_1 are given respectively by proposition 4 and 2.

Proposition 4. *The social financial contract,* $\left(\mathcal{R}^{2S}, \mathcal{R}^{S}\right)$*, implying the lowest expected transfer for entrepreneur 1 is given as follows.*

- ***For*** $R_1 \geq \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta}$,

$$\mathcal{R}^{2S} = \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta},\ \mathcal{R}^{S} = 0.$$

- ***For*** $\overline{M} \equiv \max\left\{2\frac{B}{\Delta} + \frac{1-(2p_L+\Delta)}{p_L+\Delta}\frac{B}{\Delta}, 2\frac{B}{\Delta} + \frac{1-(2p_L+\Delta)}{1-(p_L+\Delta)}\frac{I}{p_L+\Delta}\right\} \leq R_1 < \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta}$ ***and*** $2p_L + \Delta < 1$.

$$\mathcal{R}^{2S} = \frac{1}{1-(2p_L+\Delta)}\left(R_1 - 2\frac{B}{\Delta}\right),\ \mathcal{R}^{S} = \frac{1}{1-(2p_L+\Delta)}\left(2\frac{B}{\Delta} - (2p_L+\Delta)\,R_1\right).$$

- ***Otherwise***

There is no feasible social financial contract.

Proof. See technical appendix. □

Corollary 2. *The* ***expected cost*** *of the social financial contract,* $\left(\mathcal{R}^{2S}, \mathcal{R}^{S}\right)$*, implying the lowest expected transfer for entrepreneur 1 is given as follows.*

- ***For*** $R_1 \geq \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta}$,

$$\frac{2\left(p_L+\Delta\right)^2}{2p_l+\Delta}\frac{B}{\Delta}.$$

- ***For*** $\overline{M} \equiv \max\left\{2\frac{B}{\Delta} + \frac{1-(2p_L+\Delta)}{p_L+\Delta}\frac{B}{\Delta}, 2\frac{B}{\Delta} + \frac{1-(2p_L+\Delta)}{1-(p_L+\Delta)}\frac{I}{p_L+\Delta}\right\} \leq R_1 < \frac{1}{p_L+\frac{\Delta}{2}}\frac{B}{\Delta}$ ***and*** $2p_L + \Delta < 1$.

$$\frac{(p_L+\Delta)}{1-(2p_L+\Delta)}\left(2\left(1-(p_L+\Delta)\right)\frac{B}{\Delta} - p_L R_1\right).$$

- ***Otherwise***

There is no feasible social financial contract.

Proof. See technical appendix. □

In order to provide more insight in the social financial contract, its expected cost is graphed in figure 3.

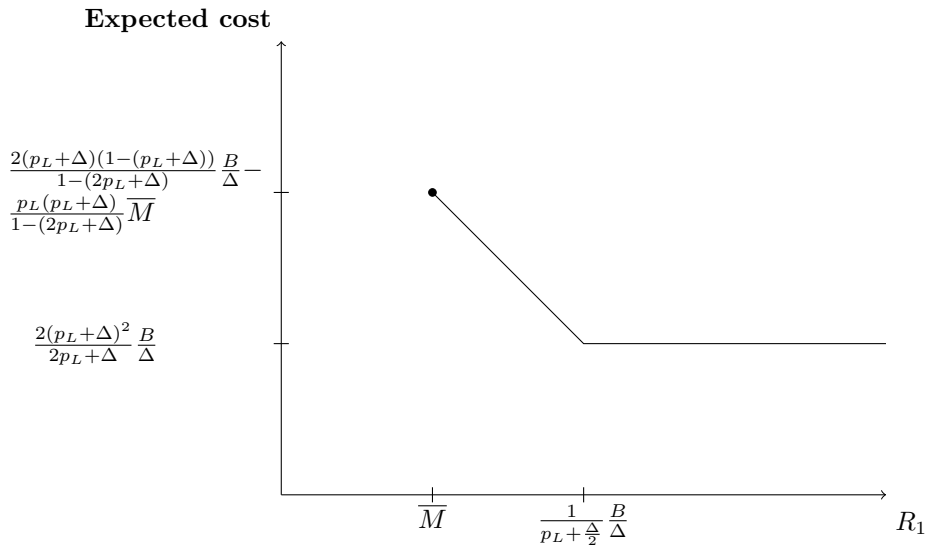

Figure 3: Expected cost social financial contract

Figure 3 clearly indicates that the expected cost of the social financial contract is (weakly) decreasing in R_1, the revenues generated when P_1 succeeds. Indeed, the cheapest way to provide incentives for both financial and externality effort is by granting E a positive payment only when both P_1 and P_2 succeed and nothing otherwise. Such a contract is feasible for $R_1 \geq \frac{1}{p_L+\frac{\Delta}{2}}\frac{B}{\Delta}$.

The assumption of limited liability however may prevent a contract which piles all incentives in a single state to be feasible when R_1 is relatively low, i.e. when $R_1 < \frac{1}{p_L+\frac{\Delta}{2}}\frac{B}{\Delta}$. In this case, the financier needs to shift rewards from the state in which both projects succeed to the state in which P_1 succeeds but P_2 fails. That is, $\mathcal{R}^S$ becomes strictly positive.

Providing incentives when the limited liability constraint binds however can be seen to be more costly as the expected cost of the incentive contract increases as R_1 falls below $\frac{1}{p_L+\frac{\Delta}{2}}\frac{B}{\Delta}$.

Finally, for $R_1 < \overline{M}$, there is no more feasible social financial contract and the financier can not finance P_1 while incentivizing both financial and externality effort.

Social financial contract as a solution to the credit constraint problem After having characterized the social financial contract we can now turn to an analysis of the conditions under which it can solve the credit constraint problem identified above. To make the exposition as clear as possible, a graphical analysis will be carried out which identifies the conditions under which a project is credit constrained or not and when it can be financed through a social financial contract.

These conditions are captured by the following set of bounds on the model parameters and summarize the findings of the above sections.

$$R_1 < \frac{I}{p_L + \Delta} + \left(1 + \frac{(1 - (p_L + \Delta))\, p_L}{(1 - \Delta)\,(p_L + \Delta) + \Delta\,(1 - (p_L + \Delta))}\right) \frac{B}{\Delta}. \tag{CC}$$

$$R_1 \geq \frac{I}{p_L + \Delta} + \frac{2\,(p_L + \Delta)}{2p_L + \Delta} \frac{B}{\Delta} \tag{EB}$$

$$R_1 \geq \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta}, . \tag{LB_1}$$

$$\overline{M} \equiv \max\left\{2\frac{B}{\Delta} + \frac{1 - (2p_L + \Delta)}{p_L + \Delta}\frac{B}{\Delta}, 2\frac{B}{\Delta} + \frac{1 - (2p_L + \Delta)}{1 - (p_L + \Delta)}\frac{I}{p_L + \Delta}\right\} \leq R_1 < \frac{1}{p_L + \frac{\Delta}{2}} \frac{B}{\Delta} \tag{LB_2}$$

and $2p_L + \Delta < 1$.

First, the CC bound reflects when P_1 is credit constrained under standard financial contracts. Then, if the credit constraint problem is to be resolved through a social financial contract the existence bound EB needs to be satisfied. Finally, the project can ultimately be financed through a social financial contract if it satisfies either the bound LB_1 or LB_2. In the former case the social financial contract paying off only when both P_1 and P_2 succeed is feasible, in the latter case the social financial contract pays of in the state in which only P_1 succeeds as well.

Figures 4, 5 and 6 now display the bounds on R_1 as a function of one of the model parameters.

Figure 4 first plots the R_1 bounds against Δ.

Δ represents the extent to which shirking on either financial or externality effort can be detected by observing the projects' outcomes. As such it is inversely related to the severity of moral hazard in the model. That is, the larger Δ, the less severe is the moral hazard problem in the model and this is reflected in the downward slope of the CC, EB, LB_1 and LB_2 bounds. [8]

[8] As was commented above, Δ drives both the moral hazard problem for financial and externality effort in the model. This assumption greatly simplifies the analytical exposition of the model and comes at little loss of generality in terms of comparative statics results. In particular, if shirking on either financial or externality effort is harder to detect, i.e. lower Δ, then the credit constraint problem will appear for a wider range of projects and the social financial contract will be less likely to appear as a solution to the credit constraint problem. To see this, first note that when financial effort is harder to detect then P_1 is all else equal harder to finance because the entrepreneur needs to retain a larger fraction in his project in order not to shirk on financial effort. This then reduces the chances that the financier can break even on his project especially in light of the third party's externality contract. A deterioration in the moral hazard problem for financial effort thus increases the chance that the credit constraint problem under standard financial contracts appears. Next suppose externality effort is harder to detect. Then, all else equal, it will be more expensive for the third party to incentivize the entrepreneur using

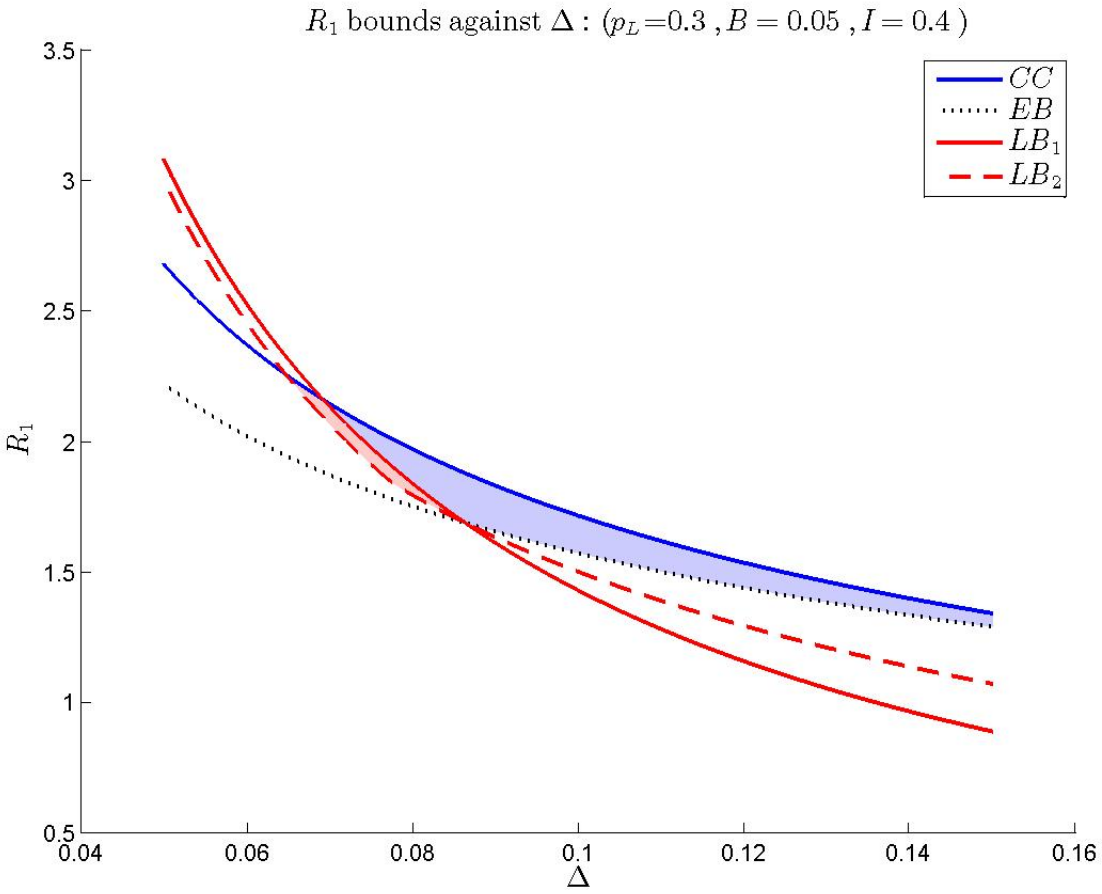

Figure 4: R_1 bounds against Δ.

In the graph, the blue and red shaded areas represent those credit constrained projects which can obtain financing through a social financial contract. First, the blue shaded area represents the credit constrained projects that are profitable enough to be financed through a social financial contract which concentrates all rewards in the state in which both P_1 and P_2 are successful.

Secondly, the red shaded area represents the credit constrained projects which are not profitable enough to be financed through a social financial contracting all rewards in the double success state, but which can be financed through a social financial contract which also rewards success of P_1 alone.

Figure 4 shows that as Δ increases, both the blue and red shaded area come to represent projects with lower R_1. This is because the credit constraint problem first of all becomes less severe and only poorer projects become struck by it, but also because the solution in the form of social financial contracts becomes

only rewards. The third party's incentives for using penalties then increases which again increases the chance that the credit constraint problem appears. Finally, the social financial contract incentivizes both financial and externality effort at the same time and therefore becomes more expensive if either type of effort is harder to observe. If the social financial contract becomes more expensive, it becomes less likely that it can serve as a solution to the credit constraint problem.

feasible for projects with a lower R_1. Overall, as Δ increases, social financial contracts can be expected to appear for projects with a lower payoff R_1.

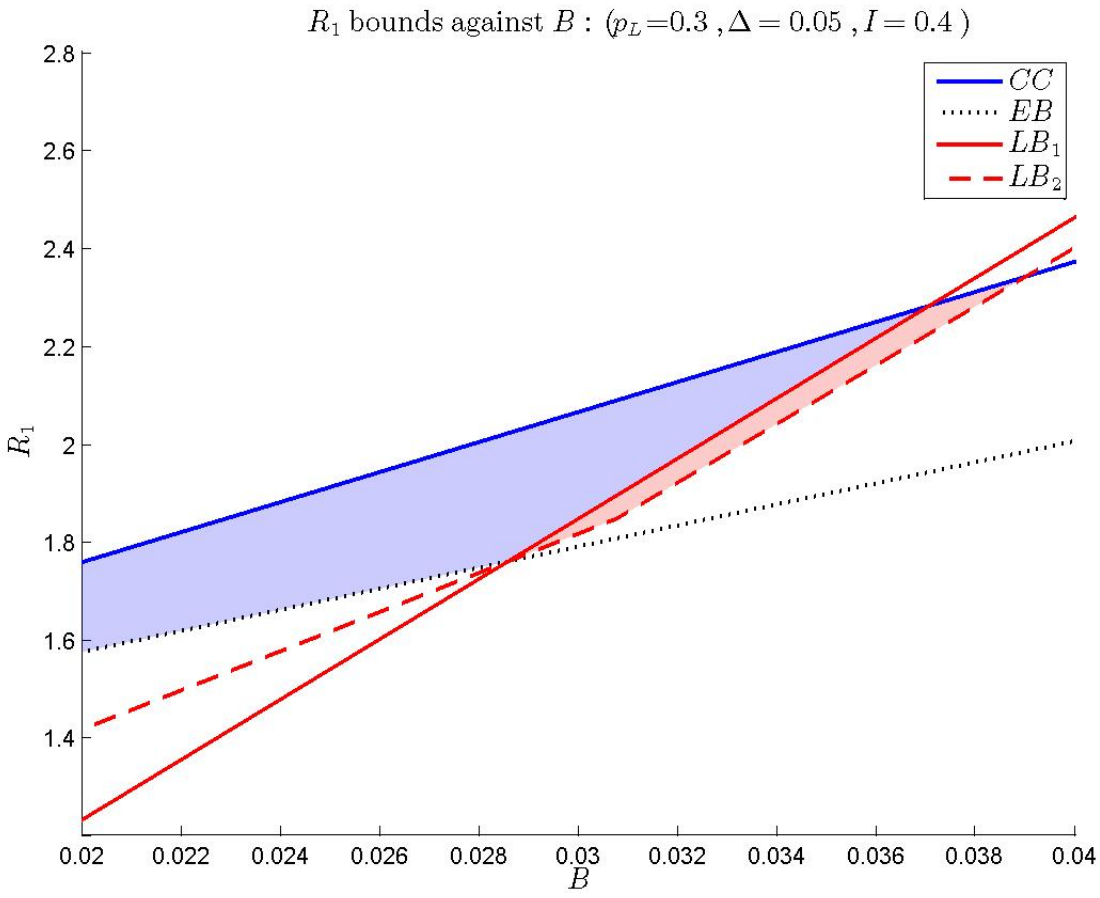

Figure 5: R_1 bounds against B.

In figure 5, the R_1 bounds are plotted against B.

The logic here is very similar to that of figure 4 since B is also a direct measure of the severity of the moral hazard problem. The larger is B, the larger the private benefits from shirking and hence the larger the incentive payments needed to ensure that the entrepreneur exerts either financial or externality effort.[9]

We see the same pattern appearing as for figure 4 in that as the moral hazard problem worsens only projects with relatively higher R_1 can be expected to be financed through social financial contracts.

Furthermore we see that for low B, the credit constraint problem is primarily resolved through a social financial contract with a single state reward concentration. As B increases and the credit constraint problem becomes more severe, the financier can first resort to two state reward social financial contract in

[9] A similar remark as for Δ applies regarding the introduction of heterogeneity in B.

order to finance projects with lower R_1's and then to single state reward contracts for projects with higher R_1's.

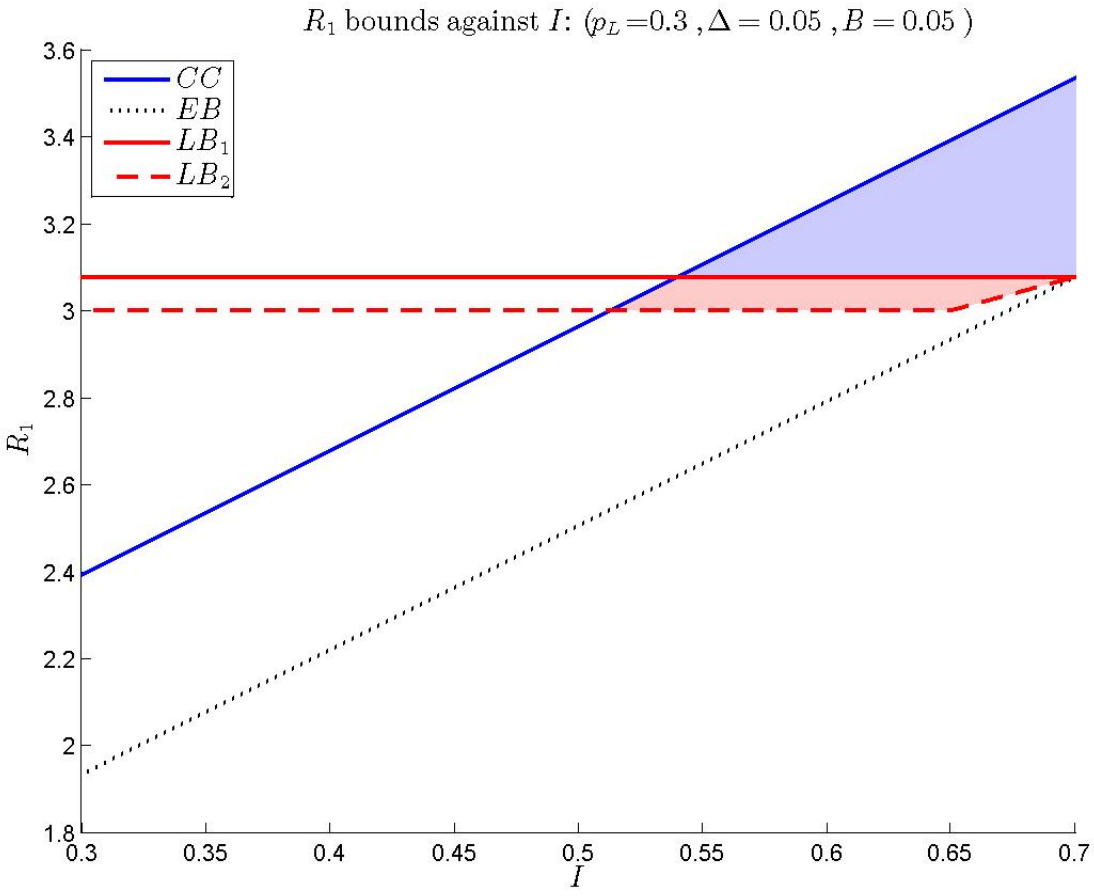

Figure 6: R_1 bounds against I.

Finally, figure 6 plots the R_1 bounds against I.

We see that for low I only projects with low R_1 are credit constrained. At the same time however, these projects can not obtain financing through a social financial contract to solve the credit constraint problem.

Only when I increases and the credit constraint problem worsens will financing be able to be provided to credit constrained projects through a social financial contract. In fact social financial contracts of both types are observed in equilibrium: contracts which pay-off only in one state and contracts which pay-off in two states.

2.4 Empirical implications

The model in the paper leads to two main empirical predictions regarding the use of social financial contracts, both which could be tested empirically in future research.

First, the paper predicts an inverted U-shape relationship between a project's financial performance, as defined by the revenues it generates, and the extent to which a project is financed through a social financial contract. In particular, the model results indicate that a project needs to be sufficiently poor in order not to be financeable through a standard financial contract, yet sufficiently rich so that it can be financed through a social financial contract.

Anecdotal evidence seems to back this prediction. In particular, impact investors often claim that their actions provide financing to projects which traditional investors are not willing to fund either because they are too small or not profitable enough. This may hint at a credit constraint problem for poorer projects in line of what was identified in the model. Though the model predicts that any investor may then provide financing through a social financial contract, in reality it might be that some level of expertise is needed in order to offer social financial contracts. Impact investors may then step up to the plate and solve the credit constraint problem by financing certain projects through a social financial contract.

Secondly, in the discussion of the model it was emphasized that the results in the paper rely on the presence of a third party agent with strong bargaining power. The strong bargaining position of the third party is necessary in the model in order to allow him to provide incentives through penalties and minimize the rents flowing to the entrepreneur. In addition, it was suggested in the paper that the strong bargaining power can originate from a variety of sources ranging from social pressure from the local community or the entrepreneur's social network but also pressure groups which support the third party's cause.

All else equal, the model then suggests that social financial contracts might be expected to be observed more often when well organized pressure groups backing the third party agent are present or when the entrepreneur himself is strongly embedded in the third party's local community. In addition, membership of the entrepreneur to various social organizations might also suggest whether a relatively poor entrepreneur may need to resort to social financial contracts in order to obtain financing for his project. Though such data might not be easy to come by, it would be interesting to find proxies for the above variables and test the relationship between impact investing on the one hand and social pressure and pressure groups on the other.

3 Conclusion

Why do we sometimes observe investors providing firms or entrepreneurs with incentives to deliver a social or environmental impact through financial contracts? Two motivations have traditionally been put forward for the existence of what can be called social financial contracts.

First, to the extent that there is a direct positive link between a firm's financial and its social or environmental performance, firms that do good may also be expected to do well. Under this logic, investors who prioritize on financial performance have an immediate interest in ensuring that firms pay sufficient attention to their social or environmental impact. Impact investing can then be viewed as a new asset class which may deliver attractive returns.

Secondly, in the absence of such a direct link, impact investing may be driven by investors with altruistic motives. In particular, to the extent that delivering a positive social or environmental impact is costly, it is not trivial that firms would have the necessary incentives in place to exert positive externalities. Investors can put these incentives in place, but this is likely to be a costly activity and only altruistic motives may be able to explain why these investors are willing to accept a lower return on investment.

This paper however advances a third reason for why we might observe social financial contracts. In particular, social financial contracts solve a credit constraint problem caused by ex-post contracting between a firm which can exert a positive externality and a third party agent benefitting from it.

In particular, if the entrepreneur does not have a direct interest in the positive externality, he will need outside incentives to deliver it. The third party agent can provide these incentives, but the paper shows that he may interfere with the incentives for financial effort put in place by the financier financing the entrepreneur's project. In particular, if the financier is restricted to using standard financial contracts, he may not be able to prevent the third party agent from disincentivizing the entrepreneur for making financial effort. If the financier can not break even when the entrepreneur shirks on financial effort, he will not be willing to finance the entrepreneur's project. The entrepreneur is said to be credit constrained under standard financial contracts.

A social financial contract can solve this problem because it removes the need for ex-post externality contracting. In particular, through a social financial contract the financier puts incentives in place not only for financial effort but also for the third party agent to deliver the social or environmental impact. The feasibility of such a contract however relies on the entrepreneur's project being sufficiently profitable.

The main empirical prediction this paper makes is then that impact investing can be expected to be observed for projects which are neither too rich, so that they are struck by the credit constraint problem under standard financial contracts, and neither too poor, so that financing is still feasible under a social financial contract.

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A Financial contracting with penalty: $\left(R^S, R^F\right)$

In this appendix it is shown that if the financier is allowed to collateralize the externality contract, he can offer a financing contract which ensures that TP will offer E a social externality contract. If TP offers a social externality contract, then the financier for sure will finance E.

In order to make the argument, an additional assumption needs to be made on the profitability of P_2. In particular, P_2 will need to be sufficiently profitable to allow the financing contract which will be suggested below to indeed lead TP to be able to offer the social externality contract. This assumption significantly simplifies the exposition without affecting the main point the paper seeks to make.

As has been argued in the paper, since both the financier and E obtain the same expected utility under the financing contract which collateralizes the externality contract and under the social financial contract, both contracts can appear in equilibrium.

Consider now a financial contract which can collateralize the externality contract. Such a contract is a pair, $\left(R^S, R^F\right)$, where R^S is a stake in the success of P_1 and R^F a penalty when P_1 fails but P_2 succeeds. In order to show that the credit constraint problem disappears, it suffices to show that the financier can stipulate a contract which E will accept and which will lead TP to offer a social externality contract with probability one.

Consider the following financing contract

$$R^S = 0,\ R^F \geq \frac{1}{p_L + \Delta}\left(\frac{B}{\Delta} + \epsilon\right), \tag{A_1}$$

where $\epsilon > 0$ and small.

First, it will be shown that the non-social externality contract is not feasible for TP by focussing on one of the incentive compatibility constraints and one of the limited liability constraints which define a non-social externality contract.

In particular, in order for a non-social externality contract to be incentive compatible, E has to prefer to shirk on the financial dimension and exert effort on the externality dimension over exerting effort on both dimensions. That is, he needs to prefer $e_a = 0$, $e_b = 1$ over $e_a = 1$, $e_b = 1$.

Conditional on a contract $\left(R^S, R^F\right)$, this incentive constraint can be written as

$$r^F \geq \frac{1}{1 - (p_L + \Delta)}\left(R^S - \frac{B}{\Delta}\right) + \frac{p_L + \Delta}{1 - (p_L + \Delta)} R^F. \tag{A_2}$$

In addition, in order for a non-social externality contract to be feasible the penalty r^F needs to be restricted by the stake R^S, E has in P_1. This is because under the assumption of limited liability, E can only be penalized in the externality contract to the extent that the finance contract stipulates a positive

stake R^S. In particular,

$$r^F \leq R^S. \tag{A_3}$$

If we now plug in financial contract A_1 in the incentive compatibility constraint A_2 and the limited liability constraint A_3, they can be rewritten as respectively

$$r^F \geq \frac{1}{1-(p_L+\Delta)}\left(0-\frac{B}{\Delta}\right)+\frac{p_L+\Delta}{1-(p_L+\Delta)}\frac{1}{p_L+\Delta}\left(\frac{B}{\Delta}+\epsilon\right) \tag{A_2}$$

$$r^F \geq \frac{\epsilon}{1-(p_L+\Delta)>0}. \tag{1}$$

and

$$r^F \leq 0. \tag{A_3}$$

In other words, the incentive compatibility constraint A_2 requires r^F to be strictly greater than 0, while the limited liability constraint A_3 requires r^F to be no greater than 0. Clearly, the incentive compatibility constraint A_2 and the limited liability constraint A_3 contradict each other. Therefore, TP can not offer a non-social externality contract if the financier offers a financing contract A_1.

The social externality contract on the other hand is feasible as long as P_2 is sufficiently profitable. Otherwise, TP will prefer not to write any externality contract at all.

The cheapest social externality contract TP can offer in response to the finance contract can be shown to be a contract

$$r^S = \frac{1+\Delta}{p_L+\Delta}\frac{B}{\Delta}, r^F = 0. \tag{A_4}$$

This contract satisfies all constraints of a social externality contract provided that P_2 is sufficiently profitable. In particular R_2 needs to satisfy the following condition,

$$R_2 \geq \left(\frac{1+\Delta}{\Delta}\right)\frac{B}{\Delta}.$$

As indicated above, to simplify the exposition of the arguments in the paper, it will be assumed that this condition holds.

Assumption 7.

$$R_2 \geq \left(\frac{1+\Delta}{\Delta}\right)\frac{B}{\Delta}$$

What now remains to be shown however is that E and the financier are willing to sign financing contract A_1. For the financier it is clear that such a contract allows him to break even since the contract only consists of a penalty. It is not so clear however that E will accept such a contract. E will accept the contract however through the expected revenue he expects to get from the externality contract offered by TP.

If E refuses the contract, he remains with his outside option of shirking on both tasks since he can't contract with TP if he does not have his project. This leaves him a utility of $2B$.

If E accepts the offer from the financier, he essentially accepts the penalty stipulated for failure in the financing contract and the expectation of contracting with TP for the externality.

In total, the expected utility of E is given by

$$\left(2 + \frac{p_L}{\Delta}\right) B.$$

Since this exceeds $2B$, E can be expected to accept the financier's offer.

B Externality contracting with bonus: $\left(r^{2S}, r^S, r^F\right)$

In this section it will be argued that TP needs to be limited in offering a contract of the form $\left(r^S, r^F\right)$ in order for the credit constraint problem to appear. In particular, if TP has the contractual freedom to offer a contract $\left(r^{2S}, r^S, r^F\right)$, which allows for a payment r^{2S} conditional on the success of both P_1 and P_2, then the credit constraint problem disappears under the assumptions made in the paper.

In order to make the argument, it suffices to focus on the case in which the social externality constraint does not bind at E's individual rationality constraint. This is the case in which E walks away with some rents from P_2 when contracting with TP.

The reason for this is that if both the social and non-social externality contract were to bind at their respective individual rationality constraints for E, the social externality contract would automatically be cheaper. This results from the fact that if the non-social externality contract is offered, TP always has to compensate E for any loss in expected utility from accepting a contract which removes his incentives to exert high effort. The social externality contract does not suffer from this drawback.

In particular, E's individual rationality constraint for the social contract binds at B, while for the non-social contract it binds at $\Delta R^S > B$ for $R^S > \frac{B}{\Delta}$. As was argued above, the financier needs to set $R^S \geq \frac{B}{\Delta}$ for there to be any chance that the social externality contract dominates the non-social contract.

Consider now the region of R^S for which the social externality contract fails to bind at E's individual rationality constraint. This region is given by

$$\frac{B}{\Delta} \leq R^S \leq \frac{B}{\Delta} - \frac{p_L}{1-(p_L+\Delta)}\left(R_2 - \frac{(1-p_L)}{p_L+\Delta}\right)\frac{B}{\Delta},$$

where

$$1 \geq 2p_L + \Delta$$

and

$$R_2 < \frac{(1-p_L)}{p_L+\Delta}.$$

For this parameter region, the expected cost of the social externality contract is given by

$$\frac{(p_L+\Delta)(1-(p_L+\Delta))}{1-(2p_L+\Delta)}\frac{B}{\Delta} - \frac{p_L(p_L+\Delta)}{1-(2p_L+\Delta)}R_2 - \frac{(p_L+\Delta)(1-(p_L+\Delta))}{1-(2p_L+\Delta)}\left(R^S - \frac{B}{\Delta}\right),$$

while the expected cost of the non-social externality contract is given by

$$B + \Delta\left(R^S - \frac{B}{\Delta}\right).$$

From the above we see that in order for the social externality contract not to break even, R_2 needs to satisfy an upper bound. This upper bound is given by,

$$R_2 < \frac{(1-p_L)}{p_L+\Delta}.$$

However in appendix A assumption 7 states that,

$$R_2 \geq \frac{1+\Delta}{\Delta}\frac{B}{\Delta}.$$

It is now easy to show that these two conditions contradict each other since,

$$\begin{aligned}
&\frac{1+\Delta}{p_L+\Delta}\frac{B}{\Delta} > \frac{1-p_L}{p_L+\Delta}\frac{B}{\Delta} \\
\Leftrightarrow &p_L + \Delta + p_L\Delta + \Delta^2 > \Delta - \Delta p_L \\
\Leftrightarrow &p_L + p_L\Delta + \Delta^2 > -\Delta p_L
\end{aligned}$$

Therefore, under the lower bound on R_2 assumed in the paper, TP can always offer a social externality contract for which E's individual rationality constraint binds. This will imply that the social externality contract will always be chosen by TP and will prevent the credit constraint problem from occurring. As was

mentioned in the paper, the assumption that TP can't include a conditional payment r^{2S} in his contract can be justified by arguing that complexity and writing costs prevent TP from writing a contract which conditions payments both on the success of P_1 and P_2.