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Mood effects in optimal debt contracts

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ABSTRACT

The impact of strong emotions or mood on decision making and risk taking is well recognized in behavioral economics and finance. Yet, and in spite of the immense interest, no study, so far, has provided any comprehensive evidence on the impact of such emotions on financial contracts and particularly on debt contracts. This paper provides the theoretical framework to study the impact of mood on financial contracting.

1. Introduction

Emotion psychology and behavioral finance literature has been shown that the decision making process and the risk taking attitudes of banks' managers and other practitioners in the financial industry are highly affected by their mood and emotions. However, there is not any comprehensive study, to formalize these experimental findings of mood biases on financial contracting and on debt contracts, as well. This theoretical study comes to fill this gap and to provide an assessment of the association between mood effects and debt contracts.

Our analysis extends the basic Lender–Borrower relationship encountered in Freixas and Rochet (2008) in aim to accommodate mood effects in the utility function viz. the approach of Rabin (1993). When we introduce adverse selection, the mood bias is also attributed by the perception of probabilities over the different types of Borrowers. In particular, we assume that these probabilities are distorted in the sense of Quiggin (1982), either directly affected by the mood bias of the Lenders or by their hierarchical preferences of the decision outcomes.

This model contributes to the theoretical foundations for a body of evidence that considers that behavioral considerations can play a role in asset price formation. For example, Kamstra et al. (2015) suggest that seasonal variations in Treasury returns are correlated with variations in the risk aversion of investor due to mood effects. Further, Baker and Wurgler (2007) use investor sentiment, i.e. belief about future cash flows and investment risks that is not justified by the facts at hand, to explain and predict stock returns. From a theoretical standpoint, Mehra and Sah (2002) provide a framework to explain the volatility in equity prices by the correlated fluctuations in the subjective preferences of investors overtime. Our model differs by considering mood bias as instantaneous and idiosyncratic. Moreover our emphasis is given on generic debt contracts rather than on equities. Finally, like Kamstra et al. (2015) we emphasize on variations on risk aversion and not on preference parameters as suggested by Mehra and Sah (2002).

2. The basic model

In a competitive environment, a Lender and a Borrower negotiate upon a debt contract for the financing of an investment project. Specifically, the Lender intends to fully finance the level of investment I that will have payoff attributed by a random variable Y taking two values $Y_h > Y_l > 0$. Both agents observe the realization of Y and the underlying contract determines the sharing of its value.

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Once payoff Y is realized, the Lender receives a repayment $R(Y_j)$ $(j = h, l)$, while the Borrower gets $Y_j - R(Y_j)$. For simplicity, we denote $R(Y_j)$ with R_j.

Both agents have standard von Neumann–Morgenstern utility functions (with Bernoulli utilities u_B, u_L) that exhibit constant absolute risk aversion. The Lender offers the debt contract $\{R_h, R_l\}$ and the Borrower accepts or rejects the offer. For common prior p on payoff, the optimal debt contract solves the following program,

$$\begin{aligned} &\max_{(R_h,R_l)} pu_B(Y_h - R_h) + (1-p)u_B(Y_l - R_l) \\ &\text{s.t.} \\ &pu_L(R_h) + (1-p)u_L(R_l) \geq \bar{u}_L. \end{aligned} \tag{Pr.A}$$

The $\bar{u}_L$ denotes the utility the Lender enjoys from an outside option, say the investment in a risk-free asset (i.e. a demand deposit). At the optimal level (see Appendix A), the marginal repayment of the Lender is determined by the risk appetite of both agents. In exposition,

$$R_j' = \frac{A_B(j)}{A_B(j) + A_L(j)}, \quad j = h, l, \tag{1}$$

with A_L, A_B the (negative) absolute risk aversion coefficients for the Lender and the Borrower, respectively. Noticeably, the optimal debt contract depends on the risk premium the agents ask for their participation in this venture. For instance, the higher the risk aversion of the Lender (A_L), the lower should be the marginal repayment (or equivalently, the higher the repayment) of the Lender. Mood effects like the rush of doing business, the animal spirits or the "fear of regret" by similar failing projects are factors that affect the risk appetite of agents and, in consequence, the debt contract formation. Next, we modify the preferences of agents to encompass their mood effects and conceptualize how the latter fuel their risk appetite.

In our specification it is the Lender that proposes the debt contract, hence we isolate on the mood effects of Lender, only. We claim that the Lender has an *ex ante perception* of the utility level the Borrower will enjoy from this venture. Consider the function,

$$u_B^e = ku_B(Y_h - R_h) + (1-k)u_B(Y_l - R_l), \tag{2}$$

for scalar $k \in [0, 1]$. If the parameter k approaches one, the Lender is optimistic for the realization of a high payoff and anticipates that the Borrower will likely be rewarded with utility $u_B(Y_h - R_h)$. While p is the objective and fully observable probability of a high payoff realization, k, to the contrary, expresses the subjective bias or the hunch of the Lender that will be a high payoff project. Of course, any misjudgment will cause to the Lender (*ex post*) a disutility either in terms of regret or by increasing the record of bad projects approved by the Lender.

For capturing this effect, define the *mood effect* function to be:

$$m_L(u_B(Y_j - R_j); u_B^e) = \frac{u_B(Y_j - R_j) - u_B^e}{\Delta u_B}, \tag{3}$$

for $j = h, l$ and $\Delta u_B = u_B(Y_h - R_h) - u_B(Y_l - R_l) > 0$. If a positive mood effect is not fulfilled the function takes negative values. In contrast, if a negative mood effect is not fulfilled then the Lender receives a windfall and the function takes positive values. The *enhanced* (Bernoulli) utility of Lender with mood effects takes the form,

$$U_L(R_j) = (1 + m_L)u_L(R_j), \tag{4}$$

for $j = h, l$. In case of a correct judgment, the numerator of Eq. (3) becomes zero and the enhanced utility reduces to the standard case.

Now suppose that the Lender solves (Pr.A) for the enhanced utility (Eq. (4)). Moreover, assume that either Lender totally likes the project $(k = 1)$ or totally dislikes it $(k = 0)$. In the former case the mood effect (3) takes always non-positive values $(m_L \leq 0)$ and the opposite in the latter $(m_L \geq 0)$. At the optimum level (see Appendix A), the repayment ought to satisfy

$$R_j' = \frac{A_B(j)}{A_B(j) + A_L(j)(1 + m_L(j))} \quad j = h, l. \tag{5}$$

Let $\{R_h^m, R_l^m\}$ denotes the debt contract under mood effects. If $k = 1$ the optimal debt contract is more favorable when the low payoff Y_l is realized $(R_l > R_l^m)$ and remains unaltered when Y_h comes up $(R_h = R_h^m)$. If $k = 0$ the optimal contract penalizes the high payoff $(R_h^m > R_h)$ and remains unaltered in the case of the low payoff $(R_l = R_l^m)$. The result is summarized in the following.

Proposition 1. *For a negative mood effect $(m_L \geq 0)$ the Lender asks for a higher repayment in the high payoff Y_h. For a positive mood effect $(m_L \leq 0)$ the Lender asks for a lower repayment in the low payoff Y_l.*

Proof. See Appendix B. □

3. The model with adverse selection

A natural extension of the model is to assume asymmetric information over the quality of the investment project. Assume that there are two types of projects, the "good" projects that have probability of achieving high payoff (Y_h) p_H, and the "bad" projects that have probability p_L, with $p_H > p > p_L > 0$. We name t_1 Borrowers those that propose a "good" project and by t_2 those with a "bad" project. In a competitive environment, Rothschild and Stiglitz (1976) show that there is no pooling equilibrium and the Lender will always offer a menu of contracts, $\{(R_h^{t_1}, R_l^{t_1}), (R_h^{t_2}, R_l^{t_2})\}$. In particular, following Mimra (2011) the optimal menu of debt contracts solves the Program of the truth-revealing type (t_1) Borrower.

$$\begin{aligned} &\max_{(R_h,R_l)} p_H u_B(Y_h - R_h^{t_1}) + (1-p_H)u_B(Y_l - R_l^{t_1}) \\ &\text{s.t.} \\ &p_L u_B(Y_h - R_h^{t_2}) + (1-p_L)u_B(Y_l - R_l^{t_2}) \\ &\quad \geq p_L u_B(Y_h - R_h^{t_1}) + (1-p_L)u_B(Y_l - R_l^{t_1}) \\ &\text{and} \\ &p_H u_L(R_h^{t_1}) + (1-p_H)u_L(R_l^{t_1}) \geq \bar{u}_L \\ &p_L u_L(R_h^{t_2}) + (1-p_L)u_L(R_l^{t_2}) \geq \bar{u}_L. \end{aligned} \tag{Pr.B}$$

The first (self-selection) constraint guarantees that the Borrower always opts for the debt contract designed for its type, while the next two constraints ensure that the menu of contracts is always beneficial for the Lender.