State contingent and conventional banking: The optimal banking choice model

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ABSTRACT

This paper compares and contrasts the optimality of debt based banking and state contingent banking. We show that the advantage each of these banking types holds over the other might not be universal; rather it may be an outcome of the informational and institutional environment in which they operate. In our model, banks optimize both the riskiness of the project and moral hazard concerns to identify the most profitable banking model. We find that state contingent banking is more profitable where projects are riskier, and debt abased conventional banking is adopted for relatively lower risk projects. Our model also suggests that state contingent banking would be the optimal choice in cases where there exist greater moral hazard concerns. We explore the empirical implications of our model and find that state contingent banking would be more suitable for small firms, emerging markets, community and Islamic banking.

1. Introduction

This paper compares and contrasts the optimality of debt based banking and state contingent banking[2]. We argue that the advantage each of these banking types holds over the other might not be universal; rather it may be an outcome of the informational and institutional environment in which they operate. Assuming that the primary purpose of a bank is to manage the tradeoffs between neutralizing asymmetric information, minimizing risk and maximizing profitability, we build a model that identifies the conditions under which each banking type could become more optimal than the other. The efficiency and optimality of debt and state contingent contracts are widely debated topics in the literature. In the presence of costly state verification, debt is argued to be more optimal (e.g., Townsend, 1979; Gale and Hellwig, 1985; Williamson, 1987). The returns on a debt contract are determined ex-ante. They are independent of the outcome faced by the borrower, whether it's the profitability of the underlying business or the income earned by an individual. This neutralizes the moral hazard concerns of the lender, making the debt contract much more efficient. Interestingly, this non-state contingent nature of debt has come under severe criticism in some of the recent literature. The pre-determined rate of return exposes the contract to multiple externalities, which can result in inefficient borrowing. Mian et al. (2017)

explain the externality of debt by taking an exogenous view of the business cycle along with assuming myopia amongst borrowers and lenders. During the boom period, when the economy is doing well, the debt contracts should seem more optimal for both the lenders and the borrowers. This is because during an upturn, the defaults are low, resulting in a relatively secured return for the lenders while the borrower (particularly the borrowing firm) can enjoy the significant upside which the high growth period offers in the form of greater profits. During the downturn, when the economy underperforms, debt contracts should be less optimal as the possibility of defaults can end up imposing a cost on all parties. Ignoring the possibility of a downturn (when making decisions during an upturn) could be a possible cause of the debt externality. This externality can be neutralized by state contingent contracts. During an upturn or downturn, borrowers would have no incentive to over or under borrow in a state contingent contract.

Another stream of literature explains the externality of a debt contract by highlighting that it can make the borrower more risk averse. Mostly, the literature assumes risk preference to be exogenous to the investor's decision. Fischer (2013) argues that the inherent focus on returning the principal means that the borrowers would be risk averse in their decisions, making risk preference endogenous. Fischer (2013) explains the presence of this externality in the microfinance

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industry, where he argues that most microfinance finance ventures fail to become big businesses, owing to the fact that the debt contract makes the micro-borrowers inherently risk averse. Azmat et al. (2014) explain this externality by showing that returning the principal, which is an integral part of the debt contract, increases the riskiness of the decision in situations where the underlying projects are inherently risky. The challenge with these streams of literature is that they approach the question of debt externality from a social planner or spectator's perspective. In the moment when the decision regarding the optimality of debt has to be taken by the investor, given the informational and institutional environment, debt contract remains the most optimal contract. The state contingent contract, owing to costly state verification, remains a less viable contract. The literature on debt externality therefore proposes an external intervention by the regulator, in the form of incentive, to ensure its viability for the investor. In this paper we take a different approach from what is otherwise proposed in the literature, and try to show that the state contingent contract remains a viable, beneficial and profitable contract for certain type of borrowing while debt remains the profitable option for others. We reframe the debate regarding the superiority of each type of financing by moving away from the idea that each type is universally better than the other from a profitability perspective, towards identifying conditions where each might be better than the other. The important contribution of our paper is that it depicts state contingent banking and debt not as a universal choice between the two for all informational and institutional environments, but goes on to identify the regions where each become more optimal than the other.

We start with building a basic model involving a bank and a continuum of firms. The firms have initiated a project requiring financing from the bank. The returns from the projects are uncertain. We assume that the bank has the market power and after taking into account the firm's riskiness, decides which contract, either state contingent or debt, would more be more optimal for the bank. In case of debt contract, the bank would charge a fixed interest rate on the loan advanced. For state contingent contracts, the bank would receive a proportion of the returns from the underlying project. The rates offered on the debt contract and the proportion of profit on the state contingent contract are endogenous in the model. The firm, based on the type of the contract and the rates offered, makes a decision whether to implement a good or a bad project. The moral hazard concern can emanate from either the firm shirking in its efforts or siphoning the funds to a risker project. In our model these moral hazard concerns directly affect the bank's profitability. Our model shows that the contract type, whether state contingent or debt, affects the firm's moral hazard behavior. The bank optimizes the risk and return of the project in the presence of these moral hazard concerns. Our results show that highly risky projects, those with high variance, would have less moral hazard concerns and great profitability in the presence of state contingent banking. For projects with lower risk, debt contracts would be more profitable for the banks. We show these results by plotting iso-profit lines, and identifying regions where each type of banking would become more profitable than the other. We also discuss the empirical implications of our results for different informational and institutional environments. We argue that state contingent banking is the optimal banking model in emerging economies which are characterized by higher riskiness of projects and greater moral hazard concerns. We also make a case that for small firms, community banks and Islamic banks, state contingent banking should be more optimal than debt based banking.

Our paper contributes to two streams of literature. Firstly, the emerging literature on the externality of debt (Mian et al., 2017; Fischer, 2013), has been critical of the nature of the debt contract and supports state contingent banking as a more welfare enhancing alternative. However, they approach the discussion from a welfare perspective and ignore the viability of state contingent contracts. In this paper we have focused on the conditions and cases when state

contingent banking becomes more profitable than debt. We also contribute to the costly state verification literature. Our model is related to Ueda (2004), which focuses on the monitoring role of venture capitals and compares conventional banking with the venture capitals. Our paper adopts a similar approach. Unlike Ueda (2004), however, our paper focusses on moral hazard, which is the driving force behind the optimal choice of a project[3]. The remaining part of the paper is structured as follows. The environment is described in Section 2. Section 3 discusses the state contingent banking model. The conventional banking model with debt is explained in Section 4. Section 5 compares the two models. The empirical implications of the model are analyzed in Section 6. Section 7 finally concludes the paper.

2. Environment

In this section we discuss the economic environment in which our banking model operates. We consider an economy with three types of agents: financiers (also called depositors), entrepreneurs and a bank. Time is discrete and lasts two periods. In the first period, the bank operating as a monopoly on the loan side with aggregate deposits of 1 unit lends to a continuum of perfectly competitive entrepreneurs. Investors can also invest in a riskless storage technology which generates a gross return R_d. Entrepreneurs are agents who have ideas but no wealth of their own. To convert their ideas into projects they need to borrow from the bank. They have an aggregate demand of 1 unit for investment in their projects. In the second period, the projects generate random return x. The return to entrepreneurs cannot be less than zero because of limited liability. The entrepreneurs have a choice between implementing good projects or bad projects. Returns from good projects have a distribution with pdf $g(x)$ with continuous support $x \in [0, \infty)$, mean μ_g and variance σ_g^2. Bad projects give return according to distribution $b(x)$ in the second period, with continuous support $x \in [0, \infty)$, mean μ_b and variance σ_b^2. The distributions of returns are assumed to be such that $\mu_b < R_d < \mu_g$ and $\sigma_b^2 > \sigma_g^2$. Thus the distribution of returns of the good projects $g(x)$ first order stochastically dominate the distribution of returns of bad projects $b(x)$. Bad projects are attractive to the entrepreneurs because by choosing bad projects, they get a private benefit S. The bank is perfectly able to monitor the returns of the projects, but is unable to monitor whether agents are choosing good projects or bad projects.

The bank operating as a monopoly can choose one of the two banking models: state contingent banking or conventional banking.

A conventional bank lends money to entrepreneurs and charges them a constant gross interest rate R on the amount lent. If a project's return is less than R then the bank takes away all of the project's return. On the other hand if the project's return is greater than R, then the entrepreneurs pay only a constant interest payment R to the bank and keep the rest. Thus the return to the bank from a project will be $\min[x, R]$. A state contingent bank, on the other hand, lends money to entrepreneurs and charges them a proportion α on the return of their

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[3] Our model differs from costly state verification models used by Townsend (1979), Gale and Hellwig (1985) and Williamson (1987). These models are based on the revelation principle (Myerson, 1979), where the mechanism is designed in such a way that it is always in the interest of the borrower to report truthfully. We also follow this approach in the paper. However, due to limited liability that we assume throughout the paper, the banks cannot punish the entrepreneurs by taking more than what they received from the project. This means that upon reporting returns less than the agreed returns, the banks undertake an audit and get all the returns from the project. The cost of audit is a lump-sum cost, and since it does not enter marginal decisions, we have ignored this cost in our model. Our model also differs from Innes (1990) and their adoption of moral hazard. Our model borrows the concept that entrepreneurs exert a level of effort depending on the returns demanded by the financiers. However, our model differs from Innes (1990) with regard to the payments to the financiers by the entrepreneurs. Our model assumes a range of payments, depending on the outcome of the project, whereas Innes (1990) consider a payment of 0 in extreme case by entrepreneurs for taking good projects - a rather impractical solution.