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The financial accelerator and the optimal state-dependent contract [☆]

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ABSTRACT

In the financial accelerator literature pioneered by [Bernanke et al. \(1999\)](#) entrepreneurs are myopic and risk-neutral, and loans have a predetermined rate of return by assumption. We relax these assumptions and derive the optimal state-dependent loan contract for forward-looking risk-averse entrepreneurs. We show that financial frictions deliver less amplification under the optimal state-dependent contract.

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1. Introduction

In one of the foundational papers in the literature on financial frictions in macroeconomic models, [Bernanke et al. \(1999\)](#) – hereafter BGG – derive a contract between risk-averse lenders and risk-neutral borrowers in the costly state verification (CSV) framework of [Townsend \(1979\)](#).¹ The BGG model is widely used because of its ability to generate a financial accelerator which amplifies and propagates the impact of technology and monetary shocks in a dynamic New Keynesian framework. The underlying loan contract in BGG, which has become the standard contract for CSV models of

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¹ A non-exhaustive list of some important early contributions in this literature include [Bernanke and Gertler \(1989\)](#) and [Carlstrom and Fuerst \(1997\)](#).

financial frictions, assumes returns for lenders are predetermined and borrowers are risk-neutral and myopic, such that they maximize expected consumption in the next period only, without considering consumption in subsequent periods.²

We relax these assumptions and derive the optimal history-independent loan contract in the CSV model, which we call the *optimal contract* for simplicity.³ Following early criticism of BGG by Chari (2003), we allow returns to the lender to vary with the aggregate state of the economy. Second, we introduce forward-looking entrepreneurs who maximize the present discounted value of all future consumption instead of next period expected consumption. Third, we consider a more general constant relative risk aversion (CRRA) preference specification for entrepreneurs that nests risk neutrality, which is assumed in BGG, as a special case.

We embed the optimal loan contract in a standard dynamic New Keynesian model, similar in all respects to the model in BGG, and derive three main conclusions. First, under the optimal contract, regardless of the degree of entrepreneurial risk aversion, business cycle amplification is smaller than under the BGG contract. Second, shocks to the cross-sectional variance of entrepreneurs' idiosyncratic productivity – so-called “risk” shocks – have little to no impact on the real economy when loan contracts are optimal, in contrast with the BGG contract. While recent work by Christiano et al. (2013) emphasizes the importance of risk shocks in driving business cycles, we demonstrate that risk shocks provide amplification only when the loan contract is non-contingent, regardless of the degree of lender's risk aversion. Third, we show that the financial accelerator in the CSV framework is dependent on three key characteristics: a predetermined lending rate, loose monetary policy and extremely persistent technology shocks. We conduct a number of robustness tests in the online appendix and find that the removal of any one of these characteristics weakens or eliminates the financial accelerator.

1.1. Overview of the model and intuition

Our model consists of entrepreneurs who borrow money from a representative household and purchase capital to use in production. Entrepreneurs are identical ex ante but differ depending on the ex post realization of an idiosyncratic productivity shock. Both agents have full information about the distribution of idiosyncratic shocks ex ante. Borrowers observe the realization of their idiosyncratic shock, but lenders do not: they must pay monitoring costs to observe it.

In the BGG contract, risk-neutral borrowers guarantee a predetermined safe rate of return to lenders in order to maximize returns on their equity. As a result, borrowers absorb all risk in the economy. It should be noted that this is an assumption and not an equilibrium condition. Because of this assumption, negative shocks decrease entrepreneurs' net worth which tightens financial constraints during recessions. The fall in output from a negative shock is further exacerbated by the decline in entrepreneurial net worth, which raises the cost of borrowing and creates a vicious circle of further declines in capital prices, net worth and investment. This results in the financial accelerator: the BGG contract amplifies macroeconomic fluctuations in a dynamic stochastic general equilibrium (DSGE) model.

As we mentioned previously, three key assumptions underpin the BGG contract and the subsequent literature that utilizes CSV frictions to generate a financial accelerator effect: (1) lenders returns are predetermined; (2) entrepreneurs are myopic – they maximize their expected *next period* consumption, rather than the expected discounted stream of *all future* consumption; and (3) entrepreneurs are risk-neutral. To gain deeper understanding of the mechanisms at play in generating the financial accelerator, we first relax the above assumptions in isolation and discuss the implications. We then relax all three assumptions simultaneously to construct the optimal contract.

When lenders' returns are predetermined as in BGG, we find that to a first order approximation the equilibrium loan contract is robust to alternative assumptions on entrepreneurial myopia or risk aversion. Because the predetermined lending rate is chosen in period t to satisfy the lender's Euler equation in that specific period without the possibility of revisions in period $t + 1$, the lender's stochastic discount factor – which is invariant to the degree of entrepreneurial myopia or risk aversion – determines the rate of return. Thus, under a predetermined lending rate the equilibrium contract is identical regardless of whether entrepreneurs are forward-looking or myopic, risk-neutral or risk-averse, and the financial accelerator remains intact.

In contrast, when lenders' returns can vary with the aggregate state of the economy as Chari (2003) argued they should, the degree of entrepreneurial myopia and risk aversion matters a great deal. For example, when entrepreneurs are myopic and risk-neutral, the financial accelerator is stronger under a state-contingent lending rate than under a predetermined lending rate. Why is this so? Myopic risk-neutral entrepreneurs sell as much insurance to the representative household as they can because insurance does not affect their expected next period consumption. Risk-averse households prefer a state-contingent rate of return that is negatively correlated with household consumption. In recessions, households desire a higher rate of return because their marginal utility of consumption is high, and vice versa in booms. A state-contingent lending rate thus insulates households from fluctuations in consumption but exposes myopic entrepreneurs to larger swings in net worth. During a recession, the provision of insurance leads to very tight financial constraints for myopic entrepreneurs,

² Note that the BGG contract is optimal given the assumptions of a predetermined lending rate and entrepreneurs who maximize next period's expected consumption.

³ To be precise, we derive the optimal one-period contract with deterministic monitoring. An excellent list of references for partial equilibrium multi-period contracts includes Monnet and Quintin (2005) for stochastic monitoring, Wang (2005) for deterministic monitoring, Cole (2013) for self-enforcing stochastic monitoring, and Popov (2014, 2016) who studies the impact of enforcement frictions on optimal loan contracts as well as optimal dynamic contracts under costly state verification.

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