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Does risk sharing increase with risk aversion and risk when commitment is limited?

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ABSTRACT

I consider a risk-sharing game with limited commitment, and study how the discount factor above which perfect risk sharing is self-enforcing in the long run depends on agents' risk aversion and the riskiness of their endowment. When agents face no aggregate risk, a mean-preserving spread may destroy the sustainability of perfect risk sharing if each agent's endowment may take more than three values. With aggregate risk the same can happen with only two possible endowment realizations. With respect to risk aversion the intuitive comparative statics result holds without aggregate risk, but it holds only under strong assumptions in the presence of aggregate risk. In simple settings with two endowment values I also show that the threshold discount factor co-moves with popular measures of risk sharing.

1. Introduction

More risk sharing is expected to occur among agents when their endowment is more risky and when they are more risk averse in an environment where insurance is imperfect. Such intuitive comparative statics results are often invoked. For example, Krueger and Perri (2006) argue that within-group consumption inequality increased less than income inequality in the United States over the period 1980–2003, because as households' income becomes more risky risk sharing increases.

The literature has devoted a lot of attention to formal insurance contracts, which occur between a risk-averse agent and an insurance company. With appropriate measures of risk aversion and riskiness, risk theorists have established comparative statics results such as 'if the agent is more risk averse, he is willing to pay more to avoid a given gamble,' and 'a risk-averse agent is willing to pay more to avoid a riskier gamble.'[1] This paper looks at *mutual insurance* between risk-averse agents, and establishes similar comparative statics results.

In order to study how risk aversion and endowment risk affect risk sharing, I consider a widely used framework to model mutual insurance, namely the model of risk sharing with two-sided limited commitment (Kocherlakota, 1996). Consider two infinitely lived agents who play a *mutual insurance game* (Kimball, 1988; Coate and Ravallion, 1993).[2] In each period,

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[1] See Pratt (1964), Arrow (1965), Hadar and Russell (1969), Rothschild and Stiglitz (1970), Ross (1981), Jewitt (1987), Jewitt (1989), and others, and Gollier (2001) for a summary.

[2] I will extend the model and the comparative statics results to N agents.

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each agent receives a risky endowment, and then decides on a transfer to his risk-sharing partner. Endowment processes and realizations are common knowledge. Deviation from the first best is the result of the following assumption: transfers have to be voluntary, or, self-enforcing. That is, in every period each agent must be at least as well off in the mutual insurance arrangement as in autarky after current endowments become known. Else, agents would renege on the contract, and consume their own endowment in the current and every subsequent period.

The limited-commitment framework provides a parsimonious way to account for partial risk sharing, and it has been applied to many economic contexts: Thomas and Worrall (1988) consider an employee and an employer, Ligon et al. (2002) and Attanasio and Ríos-Rull (2000) study risk sharing between households in villages, Mazzocco (2007) examines the intertemporal behavior of couples, Kehoe and Perri (2002) consider countries, Schechter (2007) uses the model to shed light on the interaction between a farmer and a thief, and Dixit et al. (2000) apply a similar model to explain cooperation between opposing political parties.

While formal insurance is easy to measure by a scalar, since willingness to pay can be measured in monetary units, measurement is more difficult in the case of mutual insurance. This is especially so if one aims to provide comparative statics results analytically with respect to such a measure. Whenever partial risk sharing occurs in models of mutual insurance, in general the consumption allocation can only be found after solving the model by numerical dynamic programming. Therefore, instead of studying consumption directly, I propose to characterize the level of risk sharing by the discount factor β^* above which perfect risk sharing is self-enforcing, i.e., the first best is a subgame-perfect Nash equilibrium (SPNE) of the mutual insurance game.[3] Such a threshold is frequently studied in infinitely repeated, discounted games (Abreu, 1988).

The threshold β^* is determined by the trade-off between the expected future gains of mutual insurance and the utility cost of making a transfer today in the case where it is most costly. Further, below this threshold partial risk sharing occurs, which is substantially different from perfect risk sharing, because (i) idiosyncratic income shocks influence consumption, (ii) a representative agent does not exist, and (iii) redistributing income affects the consumption allocation. I call the reciprocal of this threshold, $1/\beta^*$, the level of risk sharing.

I examine general increasing and concave utility functions and two cases with respect to the endowment process. The first case, studied in Section 3.1, is where perfect risk sharing results in completely smooth consumption across states and time. That is, agents face no aggregate risk. Section 3.2 then deals with the second case, where agents still suffer from consumption fluctuations even though they share risk perfectly, i.e., there is aggregate risk. Here I assume for tractability that agents' incomes are independent. In both cases I provide conditions for risk sharing to increase, when (i) agents are more risk averse in the sense of having a more concave utility function, and (ii) the random prospect agents' face is riskier in the sense of a mean-preserving spread, or second-order stochastic dominance (SSD).

I find that when agents face no aggregate risk, but their endowment may take more than three values, a mean-preserving spread that affects the support of the endowment distribution may destroy the sustainability of perfect risk sharing with voluntary transfers. Furthermore, when agents face aggregate risk, the same can happen with only two possible endowment realizations. However, risk vulnerability is sufficient to guarantee that a riskier endowment process will decrease the threshold discount factor, provided that the limits of the support of the endowment distribution do not change and the variation of the aggregate endowment is sufficiently small. With respect to risk aversion the intuitive comparative statics result holds without aggregate risk, but in the presence of aggregate risk it holds only under strong assumptions. Hence, in models of risk sharing without commitment, intuitive incentive effects hold only in special cases. Generally, comparative statics are ambiguous and depend on particular parameters. This calls for caution when deriving policy conclusions taking into account incentive effects in limited-commitment models.

A few papers in the literature establish comparative statics results on mutual insurance subject to limited commitment. Genicot (2006) examines how the likelihood of perfect risk sharing, defined as $(1-\beta^*)$, changes with wealth inequality, in the case where preferences are characterized by hyperbolic absolute risk aversion (HARA). Fafchamps (1999) shows that one can always find a concave transformation of the utility function of one agent, or a mean-preserving spread on the random prospect he faces, that destroys the sustainability of the risk-sharing arrangement. In contrast, I consider changes that affect all agents. Further, these two papers consider only static contracts, as in Coate and Ravallion (1993), which do not result in constrained-efficient allocations in this setting (Kocherlakota, 1996). Finally, Broer (2011), extending Krueger and Perri (2011), studies the effects of redistribution taxation (which reduces the riskiness of income) on private insurance, i.e., mutual insurance with limited commitment. He provides examples of both the intuitive and the counterintuitive comparative statics result, but he does not provide general analytical conditions, which is the aim of this paper.

The rest of the paper is structured as follows. Section 2 presents the model of risk sharing with limited commitment, and shows how to determine (the reciprocal of) the discount factor above which perfect risk sharing is self-enforcing, β^*. Section 3 contains the comparative statics results related to risk aversion and riskiness. In Section 4 I show that β^* co-moves with popular measures of risk sharing (the variation of consumption relative to income, the risk-sharing measure of Lucas and Robert, 1987) in simple settings with two endowment realizations. Section 5 concludes.

[3] β^* exists by a standard folk theorem (Kimball, 1988).