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Bounded rationality and incomplete contracts

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Abstract

This paper explores the link between boundedly rational behavior and incomplete contracts. The bounded rationality of the agents in our world is embodied in a constraint that the contracts they write must be *algorithmic* in nature.

We start with a definition of contract incompleteness that seems both appealing and widely applicable. Our first task is then to show that, by itself, the algorithmic nature of contracts is not enough to generate genuinely incomplete contracts in equilibrium. As in Anderlini and Felli [Q. J. Econom. 109 (1994) 1085], we call this the *Approximation Result*.

We then proceed to consider contractual situations in which the *complexity costs* of a contract are explicitly taken into account. We consider a broad (axiomatically defined) class of complexity measures and in this framework we show that incomplete contracts obtain in equilibrium.

We also discuss extensively some recent literature directly related to the results reported here.

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Keywords: Incomplete contracts; Bounded rationality; Complexity costs

1. Introduction

1.1. Motivation

Commenting on the state of play in the research agenda on incomplete contracting Tirole (1999, p. 773) writes: 'Complexity matters because contracts are played by real players, who must not be daunted by hard-to-grasp equilibrium strategies'.

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This paper explores the link between boundedly rational behavior and the incompleteness of contracts.

Our analysis is largely based on the framework used in Anderlini and Felli (1994, 1999). We use this framework to highlight some of the difficulties that arise in generating contractual incompleteness from bounded rationality. We also discuss how this framework, once complexity costs are explicitly taken into account, can indeed generate endogenously incomplete contracts.

Once the framework is set up, our first task is to define formally what an incomplete contract is. This is not an uncontroversial issue. In a variety of different frameworks, many implicit or explicit ways of defining contract incompleteness have been put forth in the literature. These have been so varied that according to Tirole (1999, p. 743) again: '[…] there is unfortunately no clear definition of 'incomplete contracting' in the literature. While one recognizes one when one sees it, incomplete contracts are not members of a well-circumscribed family […]'. Of course, from a formal point of view, the definition we propose here applies to the model that we analyze and does not directly translate into a universally applicable one. However, we believe that it can be usefully extended to fit a wide variety of models (for instance to models with relationship-specific investments and/or asymmetric information, which we do not consider in this paper).

Our definition of an incomplete contract is based on a *benchmark* contract (which coincides with the first best in our symmetric information model), and on a test to be applied to any contract x. The result of the test splits the set of all possible contracts into two exhaustive disjoint sets: complete and incomplete contracts. An intuitive description of what the test is meant to capture is as follows. Start by looking at the partition of the state space that the contract x induces. Comparing this partition with the one induced by the benchmark contract, can we conclude that the parties who wrote contract x were somehow 'constrained' in their ability to distinguish between states of nature? If the answer is 'yes' we call contract x incomplete.

As in Anderlini and Felli (1994) our point of departure is to assume that contracts are *algorithmic* maps (Turing machines) between the state space and the actions to be taken by the two parties if a given state occurs (say the value of a sharing rule for the surplus generated by the trade). In this way, we model a 'limit case' of bounded rationality. Anything that can be computed by any imaginable finite device in a finite number of steps is algorithmic in the sense that we use here. This is a limit case in the sense that carrying out extra steps in a computation has no cost, but the number of steps must nevertheless be finite.

In a model with a countable state space (there is a continuum of states in Anderlini and Felli (1994)) we recover a version of a proposition that we refer to as the *Approximation Result*. On the one hand it is true that in some cases the first best sharing rule cannot be embodied in an algorithmic contract. On the other hand, given any contracting problem and any arbitrarily small number ε, there exists an algorithmic contract that guarantees that the parties' expected utilities are within ε, of their first best levels.

The Approximation Result can be viewed as a negative result in establishing the link between bounded rationality and contract incompleteness. Effectively, it seems to tell us that, at least in the limit case, bounded rationality in the formulation of the contract alone cannot generate any meaningful form of contractual incompleteness.