

FB/MS

A Model of Long-Term Contracts

John Bryant

July 1979

Working Paper #: 136

PACS File #: 2760

NOT FOR DISTRIBUTION

The views expressed herein are solely those of the author and do not necessarily represent the views of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

A Model of Long-Term Contracts

by John Bryant

There probably are many reasons for long-term contracts. This paper presents one explanation for this omnipresent phenomenon. Long-term contracts are the equilibrium strategies of supergames played by economic agents.

Long-term contracts are an interesting economic phenomenon. Much of the exchange that occurs in the economy involves enduring contracts. Moreover, long-term contracts, particularly in the labor market, are a key element in Keynesian macroeconomic theorizing. However, such contracts are not a part of the standard competitive theory of exchange. Surprisingly, it is only recently that they have been given serious attention in microeconomic theorizing.

Why do individuals choose to restrict their future actions? It is likely that there are many reasons for economic agents entering long-term contracts. The introduction of uncertainty is one way to violate the assumption of full information in standard competitive theory. This also provides a reason for the existence of long-term contracts. Long-term contracts are just the contingent claims on future outcomes of the Arrow-Debreu model. Economic agents restrict their future actions because risks cannot be shared on drawings with known outcomes.

Existing long-term contracts do not take the form of explicit state dependent claims, however. Recently the "new-new" labor economics has addressed this problem in a partial equilibrium framework. See, for example, Azariadis (1). It is assumed that a full set of contingent claims is not feasible because of moral hazard or other impediment. Long-term labor market contracts are approximations in the set of feasible contracts to a set of contingent claims.

In a similar vein, Robert Townsend (3) has presented a general equilibrium analysis yielding long-term contracts. Full information is violated by assuming that economic agents have asymmetric information on individual outcomes of a random process. Moral hazard problems then keep the market from yielding an optimal allocation, as state verification is impossible. However, long-term contracts allow the law of large numbers to overcome the asymmetric information on individual realizations.

This paper presents a second reason for long-term contracts. This reason does not depend upon violating the assumption of full information in standard competitive theory. Instead, it depends upon individuals facing a sequence of games, rather than a single game. This is a feature of the "new-new" labor economics, and more recently of the theory of markets of Dennis Carlton (2). In both these approaches laborers or customers "jump" to a firm at which they are then, to some degree, stuck. These are models of limited mobility. Our goal is to show that long-term contracts may be strategies of a supergame. We achieve this by providing a model of limited mobility for which they are. Because of the precedent, this model is framed in the context of the labor market. In the model, if long-term contracts are not feasible, individuals move from a "competitive" game to a dominant player game. Laborers jump to firms and are stuck. Then we allow the agents to play the supergame by introducing long-term contracts, by expanding the strategy space.

The move to the dominant player game is a convenient device. There is a unique equilibrium strategy in the game. Moreover, the dominated players have reason to prefer the supergame. However, in many applications other than the labor market, the dominant player game may not be relevant. It does seem likely, though, that economic agents are at least as uncomfortable as game theorists are

with nonunique solutions. A supergame with unique solutions may well be attractive when the alternative is moving to a subgame without a unique solution. In general, of course, playing the subgames sequentially is not the solution to a supergame.

The Model

Now let us turn to our model. As befits a paper which seeks only to demonstrate that a class of explanations is not empty, the model is a simple one.

First we describe the environment. Each period an uncountable infinity of infinitely-lived individuals are born. They are endowed with labor equally in every period. A countable number of these individuals are also endowed with a constant return eternal technology for transforming labor into a single consumption good. Only this consumption good enters individuals' utility functions, it enters them positively with no satiation. Moving to a technology initially is costless. Moving from one technology to another is costly. For any positive mass set of producing individuals, this cost is less than their product. Each period, owners of technologies bid noncooperatively for labor.

Now we consider the equilibrium strategies. First, suppose that labor is hired on a spot market, that only one-period contracts are feasible. The equilibrium has old owners appropriating the cost of moving, and thereby getting atoms of consumption. Old owners are monopsonists relative to their captive labor force. New owners appropriate nothing. But now suppose costlessly enforceable infinite-period contracts are possible. Then the above allocation is not a Nash equilibrium. The Nash equilibrium is then owners appropriating nothing and offering infinite-period contracts. The monopsonist profits are bid away. For each individual a single "competitive" supergame replaces the

sequence of a "competitive" game followed by a sequence of dominant player games. In this model, both structures are Pareto optimal, with the supergame hurting the owners.

In the model, limited mobility of labor is the reason for long-term contracts. More generally, the model demonstrates that long-term contracts may be the equilibrium strategies of supergames. Whether this is an important reason for observed long-term contracts is an empirical question.

References

- (1) Azariadis, Costas, "Implicit Contracts and Underemployment Equilibria," Journal of Political Economy 83 (December 1975), 1183-1202.
- (3) Carlton, Dennis, "Market Behavior with Demand Uncertainty and Price Inflexibility," working paper, Massachusetts Institute of Technology, 1976.
- (3) Townsend, Robert, "Contract Length and the Discipline of Enduring Relationships," working paper, Federal Reserve Bank of Minneapolis, 1979.