

A Model of Long-Term Contracts

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Long-term contracts are explained as equilibrium strategies of supergames. In the specific coherent general equilibrium model provided, limited mobility of labor, in the form of a fixed cost of moving, generates long-term contracts.

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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 possible explanation 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) and Bryant (2). It is assumed that a full set of contingent claims is not feasible. This assumption is justified by appeals to moral hazard or other impediment without being explicitly derived. Long-term labor market contracts are, then, approximations in the set of feasible contracts to a set of contingent claims.

In a similar vein, Robert Townsend (5) has presented a coherent 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. It is proven that moral hazard then keeps 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 (4). 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 coherent 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 first play a "competitive" game and then a sequence of dominant player games. 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 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 the dominant player game may not be relevant. It does seem likely, though, that economic agents are uncomfortable with nonunique solutions. A supergame with a unique solution 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 $N > 1$ T -period lived ($T > 1$) workers are born. They are endowed with L units of labor in every period. Also each period $n < N$ T -period lived owners are born. They are endowed with a constant return technology for transforming units of labor into units of a single consumption good one for one. Owners are not endowed with labor. Only the 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. The cost is cL , $0 < c < 1$. Each period, owners of technologies bid noncooperatively for labor and workers are price takers.

Now we consider two strategy spaces and the respective equilibrium strategies. First, suppose that labor is purchased on a spot market, that only one-period contracts are feasible. The owners' strategies are binding announcements of a (single) wage for the following period.^{1/} Workers' strategies are choice of owner. The equilibrium has old ($2-T$ periods old) owners appropriating the cost of moving, and thereby getting consumption. Old owners are monopsonists relative to their existing captive labor force. They offer wage of $1 - c$, which is only accepted by their captive workers. New owners appropriate nothing. They offer a wage of 1 , which is accepted by new workers. Old workers are just indifferent to moving to a new owner.

^{1/} If the owners can price discriminate, this equilibrium is considerably changed, but the supergame is unaffected.

Now suppose costlessly enforceable T-period contracts are possible. Then the above allocation is not a Nash equilibrium. A deviant new owner can, for example, offer a wage of 1 in his first period and a wage of $1 - c + \epsilon$, $\epsilon > 0$, in subsequent periods and attract all the new workers. The Nash equilibrium is, then, owners appropriating nothing and offering T-period contracts. The monopolist profits are bid away. Each worker is guaranteed a wage of 1 in all periods of his life. Owners get nothing. Their production technology is not scarce. 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, as workers never switch owners. However, the supergame hurts the owners and benefits the workers.

In the model, limited mobility of labor is the reason for long-term contracts. The long-term contract protects the worker from the future monopsony power of her chosen employer. 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

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