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by
Diego R. Palenzuela* and Justo Jorge Moreno**

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Universitat Pompeu Fabra.
** Universidad de Alcalá de Henares.

Divide et Impera: Bargaining and Incentives within a Hierarchy

Diego R. Palenzuela[*] Justo Jorge Moreno[‡]

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Abstract

We lay out a model where a principal has to bargain with an interest group, formed by two agents. We show that the principal has incentives to separate agents at bargaining. This has two types of advantages. It introduces competition between agents to fight for rents, increasing the share of the pie captured by the principal, and it induces a tournament-type situation where agents compete in effort investments to receive offers from the principal. The separation strategy of the principal has distributive implications. Agents' characteristics that make them likely candidates of receiving the bid out offer are: the incremental productivity of the principal when the latter joins the agent in a coalition; and the timing of entry in the relationship with the principal. Early entrants are more likely to become the agents that are bid out of the bargaining game.

[*]Universitat Pompeu Fabra

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[‡]Universidad de Alcalá de Henares.

1 Introduction

In this paper we are interested in the interaction between the rent bargaining game that takes place in a hierarchy and the incentives to exert effort along the hierarchy. In particular, we model the strategies taken by the principal in order to break apart the agents into different groups and bargain with each of the groups separately. Moreover, we look at the effect of this strategy of separating agents on the incentives of all agents to exert effort. We consider a setting of incomplete contracts. Profits are not verifiable and rents are the outcome of bargaining. The bargaining game between the principal and the agents has some restrictions. It occurs only once, at a specific date. Agents can voluntarily participate in the bargaining game, but previously to it they can also commit not to participate. That is, either they commit ex ante to quit the bargaining process, or otherwise they join the coalition of agents that bargain with the principal. At the bargaining stage agents are represented by a lobby that maximizes the total rent of the bargaining coalition. Moreover, the power of the lobby depends on the size of the coalition. We find that the principal has incentives to bid a subset of the agents out of the bargaining coalition. This is for two reasons. First of all, given effort levels, the profits of the principal are higher since the bargaining coalition is weakened (it has lower power plus a smaller threat point). Interestingly, the strategy of breaking the coalition of agents induces a tournament at the investment stage, so it has good incentives' properties. The consequence of the separating strategy is a dual internal labor market. A subset of the agents (the "top") receives offers ex ante in exchange of committing to abandon the bargaining coalition. The "bottom" subset of agents obtains lower rents and does engage in bargaining. Moreover, the top group of agents has greater incentives to invest in human capital.

The model is applicable to at least two different settings. In the first place, it captures the incentives of firms' owners to build a coalition with management directed to weaken labor bargaining position. In our model, the firm separates management from the rest of the labor force in the sense that management refrains from making threats at bargaining in coordination with the rest of the work-force. A dual labor market endogenously emerges, as in Doeringer and Piore (71).

A second setting where our model is applicable is to the design of policy reform. Our model suggest that, under certain conditions, the optimal strategy to circumvent resistance to reform by organized groups is for the

policy maker to identify the ideal candidate to form a coalition. The interest group is divided and resistance towards reform is minimized. Our approach to policy reform is somewhat different to the one prevailing in the literature. We focus on reforms that do not require specifically to be passed at a voting stage, but are under the discretion of a politician (a principal) that is susceptible of being affected by interest groups. The problem of the politician is to optimally set up coalitions so as to minimize the social cost of reform. The usual approach (for instance, Dewatripont and Roland (92) or Brusco and Hopenhayn (96)) to the optimal design of policies to circumvent reform is to consider cases where bill adoption depends on a referendum by the population. The population is heterogeneous and privately observes individuals' types. Bills should be passed either by majority or unanimity. As opposed to ours, in these papers the problem of the politician is to design reform so as to compromise between his preferred outcome and the condition that the bill is passed at the voting stage.

The rest of the paper is organized as follows. Section 2 presents the model and section 3 the equilibrium strategies. Section 4 derives empirical implications. Section 6 closes the paper with concluding remarks.

2 The Model

We consider a hierarchy composed by three agents: the principal, P, plus two agents, i and j. The value of production, V, depends on the level of human capital of these three agents, x_P, x_i and x_j, respectively. Value depends in particular on the set of agents that are present at the production stage. In order to simplify notation we will use x_s to mean both the level of human capital of agent s and the element "agent s" in a set. We call Ω the set of all three agents.

We assume all agents have positive marginal productivity:

$$V(x_P, x_i, x_j) = V(\Omega) > V(\Omega - s) > V(\Omega - s - t) \qquad s, t = x_i, x_j, x_P \quad s \neq t$$

and we take V to be superadditive. For any set of agents the value produced by them jointly is greater than the sum of the outputs if one of them separates:

$$V(t) > V(t - s) + V(s) \qquad \forall t, s \subseteq \Omega, \quad s \subset t, \quad s \neq t$$

The timing of actions is as follows.

- At $t = 1$ all agents decide their effort level in human capital at cost $c(x)$, increasing and convex in x.
- At $t = 2$ the asset owner can make take it or leave it rent offers to one or both agents. Employees that received offers decide simultaneously whether to accept or reject. If an agent accepts the offer he cannot enter the bargaining game between the owner and the agents, that takes place at:
- $t = 3$: this is the *hierarchy-bargaining* stage, that is played by the owner and the coalition of agents that rejected offers.
- At $t = 4$, if two agents participated at the hierarchy-bargaining stage, they bargain (with equal power) to split the surplus. This is the *agents-bargaining* stage.

We are assuming that bargaining occurs in two rounds (first,, principal vs. agents, then, possibly, agents vs. agents). Regarding the first round, in particular, the agents that did not accept offers at $t = 2$ bargain as one coalition with the principal. Agents' bargaining power, α depends on the size of the coalition. We assume that $\alpha(x_i, x_j) = 2\alpha(x_i) = 2\alpha(x_j)$ and that $\frac{2}{3} = \alpha(x_i, x_j)$.[1]

3 Equilibrium rents and investment levels

3.1 The agents-bargaining stage, $t = 4$

Consider stage $t = 4$ with levels of investments in human capital (x_P, x_i, x_j) sunk at $t = 1$. Wages will depend on the composition of the bargaining coalition at $t = 3$. At $t = 4$ there are two possibilities.. Either:

1. The agents' bargaining coalition at $t = 3$ was formed only by s, one of the agents. There is no further bargaining at $t = 4$. Equilibrium rent of x_s in this case, $\sigma_s(s)$, is given by the bargaining outcome at $t = 3$.

[1] It is the first assumption that is important, namely that employees' bargaining power depends on how many employees remain within the bargaining coalition. The second part is only a simplifying assumption that does not affect results.

2. Or it was composed by both x_i and x_j. Wages are $\sigma_i(x_i, x_j)$ and $\sigma_j(x_i, x_j)$.

Under case 2, call π_{ij} the rent bill obtained by the bargaining coalition at $t = 3$. Then π_{ij} is divided as:

$$\sigma_i(x_i, x_j) = \frac{1}{2}(\pi_{ij} - V(x_j)) + \frac{1}{2}(V(x_i)) \tag{1}$$

and $\sigma_j(x_i, x_j)$ is the symmetric of $\sigma_i(x_i, x_j)$.

3.2 The hierarchy-bargaining stage, $t = 3$

We should again consider the two cases above.

1. Take the case when both agents are in the bargaining coalition. Bargaining power of the coalition is $\alpha(x_i, x_j) = 2/3$. Since agents cooperate to bargain π_{ij} is determined by:

$$\pi_{ij} = \frac{2}{3}(V(\Omega) - V(x_P)) + \frac{1}{3}V(\Omega - x_P) = \sigma_i(x_i, x_j) + \sigma_j(x_i, x_j) \tag{2}$$

2. When only one agent, say j, is in the bargaining coalition, j bargains with the principal knowing that agent i has left the bargaining game and that i will contribute her human capital to the principal. j's probability of making take it or leave it offers is $a(x_j) = 1/3$. j's rent, $\sigma_j(x_j)$ is given by:

$$\sigma_j(x_j) = \frac{1}{3}(V(\Omega) - V(\Omega - x_j)) + \frac{2}{3}V(x_j) \tag{3}$$

3.2.1 Bargaining externalities

From (1), (2) and (3) we can see if there are bargaining externalities between agents. We want to see what is the effect of player s' acceptance of a rent offer at $t = 2$ on the equilibrium rent of s, the agent that remains in the bargaining coalition.

Remark 1 *Given superaditivity of V, if agent i leaves the bargaining game, the rent of agent j is strictly decreased* [2]*: $\Delta_j \equiv \sigma_j(x_i, x_j) - \sigma_j(x_j) < 0$.*

[2]The result does not depend on who leaves. We show that the result is true if i leaves, but is evident that the symmetric is true.

Worker j is worse off if left alone in the bargaining coalition because her ability to make it or leave it offers is reduced and because by herself she can exert weaker threats to the principal. The gain of i leaving is that j does not have to divide the surplus with i at $t = 4$. It is easy to show that for j the costs are greater than the benefits. From (1) and (2) we have:

$$\sigma_j(x_i, x_j) = \frac{1}{3}V(\Omega) + \frac{1}{6}V(x_i, x_j) + \frac{1}{2}V(x_j) - \frac{1}{2}V(x_j) - \frac{1}{3}V(x_P)$$

The rent loss to agent j when i quits the bargaining process is:

$$\begin{aligned} \Delta_j &\equiv \sigma_j(x_i, x_j) - \sigma_j(x_j) \qquad (4) \\ &= -\frac{1}{3}V(x_P) + \frac{1}{6}V(x_i, x_j) - \frac{1}{2}V(x_i) - \frac{1}{6}V(x_j) + \frac{1}{3}V(x_P, x_i) \\ &= \frac{1}{6}(V(x_i, x_j) - V(x_i) - V(x_j)) + \frac{1}{3}(V(x_P, x_j) - V(x_P) - V(x_j)) > 0 \end{aligned}$$

which is positive from the superaditivity of V. When an agent accepts an offer from the principal he exerts a negative externalities on the agents that remain in the bargaining coalition, the extent of which will depend on the degree of the complementarities in the production technology.

3.3 Bidding agents out of the bargaining coalition: $t = 2$.

The principal at $t = 2$ has two strategies: make no offers and bargain with both agents at $t = 3$ and bid one of the agents out of the bargaining coalition[3]. The profits to the principal from the first strategy, $\sigma_P(x_i, x_j)$, are:

$$\sigma_P(x_i, x_j) = \frac{1}{3}(V(\Omega) - V(\Omega - x_P)) + \frac{2}{3}V(x_P)$$

The second strategy of bidding i (j) requires to find the minimum rent such that the agent prefers accepting to rejecting and getting $\sigma_i(x_i, x_j)$ ($\sigma_j(x_i, x_j)$). But this option of i (j) when rejecting is equal to the rent offered by the principal at $t = 2$, since the principal has bargaining power at $t = 2$ and given the negative bargaining externality between agents. The

[3]Bidding both out is the same as the second strategy.

profit from the second strategy when the offer is made is the outcome of bargaining at $t = 3$ minus the rent offered at $t = 2$:

$$\begin{array}{rcl} \text{profits from bidding } i \text{ out} & : & \pi_P^i \equiv \sigma_P(x_j) - \sigma_i(x_i, x_j) \\ \text{profits from bidding } j \text{ out} & : & \pi_P^j \equiv \sigma_P(x_i) - \sigma_j(x_i, x_j) \end{array}$$

where[4]:

$$\pi_P^i = \frac{5}{12}V(\Omega) + \frac{1}{3}V(x_P, x_i) - \frac{1}{4}V(x_i, x_j) + \frac{1}{4}V(x_P) - \frac{1}{2}V(x_i) - \frac{1}{6}V(x_j)$$

Comparing π_P^i and π_P^j it is easy to see what determines the decision on to whom to make an offer at $t = 2$:

Remark 2 *the condition for the strategy "bid out i" being preferred to "bid out j" is that the increment in value from P joining i is greater than the increment from P joining j :*

$$\pi_P^i > \pi_P^j \Longleftrightarrow V(x_P, x_i) - V(x_i) > V(x_P, x_j) - V(x_j) \tag{5}$$

Without loss of generality, take i as the agent that maximizes $V(x_P, x_s) - V(x_s)$. It is easy to show that the principal is always strictly better off making an offer to i and bid her out of the bargaining coalition

Remark 3 *Under (5) and strict superaditivity of V, the principal's owner always offers $\sigma_i(x_i, x_j)$ to agent i, at $t = 2$, who accepts the offer.*

This result can be checked easily. The gain from bidding i out, G is:

$$G \equiv \pi_P(x_i) - \sigma_P(x_i, x_j) =$$

$$= \frac{1}{12}\left[V(\Omega) + 4V(x_P, x_j) + V(x_i, x_j) - 5V(x_P) - 6V(x_i) - 2V(x_j)\right]$$

From (5): $4V(x_P, x_i) > 4V(x_P, x_j) - 4V(x_j) + 4V(x_i)$ and:

$$\begin{array}{rcl} 12G & > & V(\Omega) + 4V(x_P, x_i) + V(x_i, x_j) - 5V(x_P) - 6V(x_j) - 2V(x_i) \\ & > & 5V(x_P) + 6V(x_j) + 2V(x_i) - 5V(x_P) - 6V(x_j) - 2V(x_i) = 0 \end{array}$$

[4]and where $\pi_P(j)$ is the symmetric of $\pi_P(i)$.

It is always profitable for the principal to separate agents for bargaining. In particular, it is optimal to select the agent that maximizes the value of the coalition of the principal and only one agent net of the outside opportunity of the agent, and bid him out. The principal bargains then separately with the remaining agent, that has been weakened through the secession of i.

In summary the equilibrium actions, given investment levels, are: the principal at $t = 2$ selects the agent that maximizes[5] $V(x_P, x_s) - V(x_s)$. Call that agent the *top* agent and let i be that agent. The principal offers the top agent the rent she would get when all agents bargain ($\sigma_i(x_i, x_j)$) and she commits not to bargain at $t = 3$. At $t = 3$ only agent j is in the bargaining coalition and gets the outcome of bargaining when the top agent is never threatening to leave ($\sigma_j(x_j)$). Firm's profits are: $\sigma_P(x_j) - \sigma_i(x_i, x_j)$.

3.4 Equilibrium investments: $t = 1$

At $t = 1$ agents anticipate that they will be separated at $t = 2$, when the principal bids out the *top agent*. From (4), agents prefer strictly to be selected as the top agent and quit subsequent bargaining and in order to be the one that gets the offer, they compete in effort at $t = 1$. Since we have assumed that effort decisions are sequential (first x_P, then x_i and finally x_j), given x_P agent i plays a preemption game with agent, where preemption is in respect to entering the top position.

To solve for the equilibrium efforts, we need additional assumptions about the symmetry of V. We assume in particular that::

$$\frac{\partial V(x_P, x_i, x_j)}{\partial x_i} = \frac{\partial V(x_P, x_i, x_j)}{\partial x_j} \qquad \forall\, x_P, x_i, x_j$$

and moreover that: $\Phi(x_P, y) \equiv V(x_P, y, y)$ is strictly concave.

As in preemption games, entry (into the top position) can be blocked or deterred. Let (x_P^*, x_i^*, x_j^*) be the solution to the following system of equations.

$$\frac{\partial \pi_P^i}{\partial x_P} - c'(x_P) = 0 \qquad (x_P)$$

$$\frac{\partial \sigma_i(x_i, x_j)}{\partial x_i} - c'(x_i) = 0 \qquad (x_i)$$

[5] If $V(x_P, x_i) - V(x_i) = V(x_P, x_j) - V(x_j)$ the owner is indifferent about to whom to make an offer, but he strictly prefers to make one offer. So he "flips a coin".

$$\frac{\partial \sigma_j(x_j)}{\partial x_j} - c'(x_j) = 0 \qquad (x_j)$$

We now derive conditions under which the threat of competition for the top position is binding

Remark 4 *If for all positive* ε : $\sigma_j(x_i^*, x_i^* + \varepsilon) - c(x_i^* + \varepsilon) < \sigma_j(x_j^*) - c(x_j^*)$ *equilibrium effort levels are given by* (x_P^*, x_i^*, x_j^*) *and we say that* i *"blocks entry into the top position".*

Definition 1 *Let* $\varphi()$ *be the reaction function of agent* j *as a function of an investment level by* i *of* x_i.

$$\widetilde{x}_j \equiv \varphi(x_i) = \arg\max_{x_j}\{\sigma_j(x_j) - c(x_j)\}$$

Remark 5 *If there is a positive* ε : $\sigma_j(x_i^*, x_i^* + \varepsilon) - c(x_i^* + \varepsilon) > \sigma_j(x_j^*) - c(x_j^*)$ *equilibrium effort levels are given by* $(x_P, \widehat{x}_i, \varphi_j(\widehat{x}_i))$ *and we say that* i *"deters entry into the top position".*

where $\widehat{x}_i$ is the solution[6] to:

$$\sigma_j(x_j)(x_P, \widehat{x}_i, \varphi_j(\widehat{x}_i)) - c(\varphi_j(\widehat{x}_i)) = \sigma_j(x_i, x_j)(x_P, \widehat{x}_i, \widehat{x}_i) - c(\widehat{x}_i)$$

and where from the complementarity of investments it is clear that: $\widehat{x}_i > x_i^*$ and $\widetilde{x}_j > x_j^*$. The threat of competition for the top position increases the incentives to invest of all parties. Interestingly, the principal's strategy of bidding out one agent out of the bargaining coalition induces a tournament ex ante between the two agents, in spite of the fact that there is moral hazard and contracts contingent on the profits of the principal are not used.

[6] A solution always exists. The left hand side is always increasing in $\widehat{x}_i$ from the envelope theorem and the right hand side eventually decreases in $\widehat{x}_i$ from the concavity of $\Phi(x_P, \widehat{x}_i)$ and the convexity of $c()$.

4 Empirical implications

Our model points to a number of characteristics of internal labor markets in large principals. We focus on settings of contract incompleteness such that principal profits are not verifiable. We find that:

- The principal follows a strategy of separating agents for bargaining purposes. In particular the principal wants to pay to one of the groups (the *top group*) of agents a rent large enough such that agents in this group quit subsequent bargaining.
- The principal chooses as the top group, the group such that, when the owner joins the group in a productive coalition, the incremental production of the group is maximized.
- The group that does not receive an ex ante offer (the *bottom group*) engages in bargaining and suffers a loss from the top group quitting the bargaining process. In particular, for identical investment levels the bottom group receives a smaller rent than the top group.
- Relative to the strategy of not separating agents, the strategy of separating agents improves the (marginal) incentives to invest of the top group and of the owner of the assets, and it worsens the (marginal) incentives to invest of the bottom group.
- In spite of the unverifiability of profits, the strategy of separating agents induces an ex ante tournament between the two groups to become the top group. This tournament will generally improve incentives to invest and will alleviate the underinvestment problem from moral hazard under incomplete contracts.

For empirical purposes we will focus on the core implication of the model: the set of agents within a hierarchy tend to be separated in two groups. One of them does not engage in bargaining, has higher productivity and greater incentives to invest. The other group does engage in bargaining and has worse incentives to invest and higher incentives to increase bargaining power.

5 Conclusions

We have laid out a model where the principal has incentives to create a dual bargaining regime. This has two types of advantages. It introduces competition between agents to fight for rents, increasing the share of the pie captured by the principal. Moreover, it induces a tournament type of situation where agents compete in effort investments to receive offers from the principal. The separation strategy of the principal has distributive implications: the group that does not receive an offer not to bargain is strictly worse off. Agents' characteristics that make them likely candidates of receiving the offer are: the incremental productivity of the asset owner when the latter joins the agent in production coalition; and the timing of entry in the relationship. Early entrants are more likely to become the agents that are bid out of the bargaining game.

Our model is applicable to settings like the organization of hierarchies inside firms and to policy reform when policy makers are subject to influences by interest groups. In the first case the model provides a theoretical rational for dual labor markets, where management belongs to a coalition with the firm. In the second case the model has implications on the optimal response of policy makers in front of interest groups.

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