Economics Letters 148 (2016) 91–95

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Hold-up in vertical hierarchies with adverse selection

Alberto Palermo *

EBS Business School - Rheingaustrasse 1, 65375 Oestrich-Winkel, Germany
University Paris 2 - 12 Place du Panthéon, 75231, Paris Cedex 05, France

HIGHLIGHTS

- A three-stage sequential game with hold-up and adverse selection is studied.
- The principal's capital investment implies a more favorable distribution of types.
- The regulator's trade-off concerns distortions, expected rent and investment.
- Quantities of first best are not socially desirable.
- The allocation of bargaining power is not in favor of one single party.

ARTICLE INFO

Article history:
Received 18 June 2016
Received in revised form
8 September 2016
Accepted 23 September 2016
Available online 28 September 2016

JEL classification:
C78
D02
D82

Keywords:
Bargaining
Adverse selection
Hold-up

ABSTRACT

This paper studies bargaining with hold-up in presence of adverse selection and endogenous type distribution. With limited liability for the agent, quantities of first best are not socially optimal. The allocation of bargaining power is never completely in favor of one party.

1. Introduction

This paper deals with the effects of bargaining power on incentives of parties and in particular how private decisions, which can be welfare improving, are affected in imperfect markets.

A firm (*principal*) makes an upfront investment which implies a reduction of costs of performing works for some future employees (*agents*). However, a subsequent negotiation can lead to a request of higher wages. Then, part of the surplus generated is split according to the bargaining power. That is, a common hold-up problem arises. Moreover, as in the hiring process neither the firm nor the workers know the worker's type for a future employment, a subsequent screening problem has to be considered. A negotiation *ex-ante*, for a specific task to be attempted and that assures a related payment *ex-post*, is observed in jobs the worker is supposed to start for the first time or in the case the worker starts working in a new environment or group work.[1] In regulating markets, the legal decision is to find the optimal distribution of contractual power.

Bargaining in presence of moral hazard has been studied—e.g., Deffains and Demougin (2008) and Bental and Demougin (2010) and recently Gogova and Uhlenbrock (2013) and Halac (2015). Under incomplete information, Inderst (2002) proposes a two-periods game with alternating offers and updating belief. Yet, Inderst (2003) derives conditions for subsets of parameters to show that the efficient contracts are implemented. Yao (2012) suggests the same idea with respect to the standard non-linear

* Correspondence to: EBS Business School - Rheingaustrasse 1, 65375 Oestrich-Winkel, Germany.
E-mail address: alberto.palermo@ebs.edu.

[1] Assuming that the type is revealed before bargaining takes place would require additional considerations and could lead to additional results given the possible presence of multiple equilibria.

http://dx.doi.org/10.1016/j.econlet.2016.09.025

pricing model, while Cabrales et al. (2011) offer an experimental approach to disentangle the effect of competition seen as proxy of bargaining power. However, the former models analyze a moral hazard set-up, while the latter ones do not consider the hold-up problem.

The paper proceeds as follows. Section 2 presents the set-up. Subsections analyze the game and discuss the partial results. Section 3 concludes.

2. The model

The actors are regulator, firm, and workers.[2] The game is sequential and the timing is:

1. The Social Planner determines the bargaining power;
2. The principal invests in capital;
3. The negotiation between principal and agent takes place.

The principal derives benefit $S(q)$ from the production q made by the agent, $S'(q) > 0, S''(q) < 0$. The principal makes a payment t, while the agent faces a cost for producing $C(\theta, q) = \theta q$. The monetary gain for the principal is $B(q,t) = S(q) - t$, while for the agent $U(q,t,\theta) = t - \theta q$, where $\theta \in \Theta \equiv \left\{\underline{\theta}, \overline{\theta}\right\}$ and $\underline{\theta}$ $\left(\overline{\theta}\right)$ characterizes the low-cost (high-cost) type. The probability of being low-cost is $Pr\left(\underline{\theta}\right) \in [0, 1]$.

Anticipating the outcome of the bargaining, the principal chooses the investment in capital (k) which implies a more favorable distribution of types. Formally, $v(k) \equiv Pr\left(\underline{\theta}|k\right)$, with $v_k > 0, v_{kk} < 0$.

I derive the subgame perfect equilibrium. Therefore, the analysis is carried out backwards.

2.1. Bargaining stage

In this last stage the bargaining power has been defined by the regulator and the investment in capital is a sunk cost. Therefore, they are treated as constants.

The timing of the bargaining stage is:

1. Negotiation;
2. Agent learns his type;
3. Agent selects a contract;
4. The contract is executed.

I apply the axiomatic Nash Bargaining solution to derive the results from the negotiation. The revelation principle holds and therefore I focus on the class of direct revelation mechanisms that describe *incentive compatible contracts*[3]:

$$t(q(\theta)) - \theta q(\theta) \geqslant t\left(\tilde{q}\right) - \theta\tilde{q} \quad \forall\, \tilde{q}, \theta \in \Theta \text{ and } t(\cdot) \text{ defined.}$$

Additionally, the agent is protected by limited liability.[4] That is, for every state of the world θ, parties agree on a set where:

$$U(q,t,\theta) \geqslant 0 \quad \forall\ (q,t,\theta).$$

Therefore, ex-ante, both actors negotiate on a specific menu of incentive compatible contracts $\{q(\theta_i), t_i(\theta_i)\}_{\theta \in \Theta}$ which entails ex-post, for every observed quantity $q(\theta)$, a given transfer $t(\theta)$; hence a double dimension negotiation. Denoting with $\alpha \in (0, 1)$ the bargaining power of the firm, the family of asymmetric Nash solutions solves the following (NP) program:

$$\underset{\{q_i(\theta_i),t(\theta_i)\}}{Max} \mathcal{N}\Big|_{k^*,\alpha^*} = \left\{\sum_{\theta_i} Pr(\theta_i)\left[S(q(\theta_i)) - t_i(\theta_i)\right]\right\}^{\alpha} \times \left\{\sum_{\theta_i} Pr(\theta_i)\left[t_i(\theta_i) - \theta_i q(\theta_i)\right]\right\}^{1-\alpha}$$

subject to

$$t_i(\theta_i) - \theta_i q(\theta_i) \geqslant 0 \quad \forall \theta_i \in \Theta \qquad (PC(\theta_i))$$

$$t_i(\theta_i) - \theta_i q(\theta_i) \geqslant t_j\left(\theta_j\right) - \theta_i q\left(\theta_j\right) \quad \forall\, \theta_i \in \Theta,\ i \neq j. \qquad (IC(\theta_i))$$

Using standard notation for $q(\theta_i)$, $t_i(\theta_i)$, $v \equiv Pr\left(\underline{\theta}\right)$ and denoting with $(^*)$ quantities of first best where surplus is maximized:

Proposition 1. *The program (NP) admits two candidate solutions:*

Candidate 1 (C1)*:*

$$S'\left(q_i^*\right) = \theta_i \quad \forall\, \theta_i \in \Theta$$

$$\text{with } \mathcal{C} = \frac{E[B]}{E[U]} = \frac{\alpha}{1-\alpha}.$$

Candidate 2 (C2)*:*

$$S'\left(\underline{q}^*\right) = \underline{\theta}$$

$$S'\left(\overline{q}\right) = \left[\overline{\theta} + \frac{v}{1-v}\Delta\theta\right] - \frac{1-\alpha}{\alpha}\frac{v}{1-v}\Delta\theta\mathcal{C} \qquad (1)$$

$$\text{with } \mathcal{C} = \frac{E[B]}{E[U]} < \frac{\alpha}{1-\alpha}.$$

Proof. See Appendix.

In case of an agreement on (C1), there are different combinations of bargaining power and investment in capital that do not change the quantities, but change the total surplus and the way this is split between the parties. To see this, let $\underline{w}^* \equiv S\left(\underline{q}^*\right) - \underline{\theta}\underline{q}^*$, $\overline{w}^* \equiv S\left(\overline{q}^*\right) - \overline{\theta}\overline{q}^*$ and $\mathbf{W} = v\underline{w}^* + (1-v)\overline{w}^*$ the total surplus. k changes $\mathbf{W}$ through v. The expected benefit of the principal is $E[B] = \mathbf{W} - E[U]$ while $\mathcal{C} = \frac{E[B]}{E[U]} = \frac{\alpha}{1-\alpha}$.

Conversely, in case of (C2), denoting $\overline{q}^B(\cdot)$ the quantity of bargaining implicitly defined by (1):

Lemma 1. *Other things being equal, an increase of the investment in capital or an increase in the bargaining power for the firm leads to a decrease in the quantity of the high-cost type, that is* $\frac{d\overline{q}^B}{dk} = v_k\frac{\partial\overline{q}^B}{\partial v} < 0$, $\frac{\partial\overline{q}^B}{\partial\alpha} < 0$.

Proof. See Appendix.

Disregarding for the moment the hold-up problem, the first main result is:

Corollary 1. *For a given distribution of types (a given investment in capital* $\overline{k}$*) there exists a bargaining power* $\hat{\alpha}$ *such that:*

(i) *for* $\alpha \in \left(0, \hat{\alpha}\right)$*, the quantities are at the first best and firm and worker share the total expected surplus according to their bargaining power* ($\mathcal{C} = \frac{\alpha}{1-\alpha}$)*;*
(ii) *for* $\alpha \geqslant \hat{\alpha}$*, only the quantity of the low-cost type is at the first best, while for the high-cost type the quantity of bargaining belongs to the set* $\left(\overline{q}^{SB}, \overline{q}^*\right)$*, where* $\overline{q}^{SB}$ *is the quantity obtained when the principal has all the bargaining power* ($\alpha = 1$)*;*

[2] Here the Social Planner can be seen as a "fictitious" player. Implementing this stage greatly simplifies the analysis and the exposition of the model.

[3] See Laffont and Martimort (2002) page 234–235 for a detailed exposition.

[4] A model where the rent of the agent is satisfied in expectation describes a franchise contract. I discuss the solution below.