Games and Economic Behavior 91 (2015) 75–96

Contents lists available at ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

Pessimistic information gathering ☆

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ARTICLE INFO

Article history:
Received 2 June 2013
Available online 2 April 2015

JEL classification:
H41
D82

Keywords:
Information gathering
Moral hazard
Asymmetric information
Pessimism

ABSTRACT

An agent gathers information on productivity shocks and accordingly produces on behalf of a principal. Information gathering is imperfect and whether it succeeds or not depends on the agent's effort. Contracting frictions come from the fact that the agent is pessimistic on the issue of information gathering, and there are both moral hazard in information gathering, private information on productivity shocks and moral hazard on operating effort. An optimal menu of linear contracts mixes high-powered, productivity-dependent screening options following "good news" with a fixed low-powered option otherwise.

1. Introduction

Since its early inception, agency theory has put much emphasis on how uncertainty impacts on the design of contracts and the overall performances of principal–agent arrangements.[3] Although implications for organizational design have been significant and far reaching, most of the extant agency literature has taken information structures as exogenous. Whether an agent takes actions before learning the state of nature (like in hidden action models) or after (like with hidden information) is thus a choice of the modeler to depict a given setting. However, in many circumstances agents do invest in information gathering to better tailor their actions to the realization of shocks that may impact on their performances. A more complete and probably best descriptive view of agency relationships should thus endogenize information structures. This paper belongs to a burgeoning literature that precisely contributes to such research program.

☆ For useful comments, we wish to thank Malin Arve, Antoine Bommier, Bernhard Ganglmair, Perrin Lefebvre, Manuel Marfan, David Miller, Wilfried Sand-Zantman and especially Dszeso Salay as well as participants to seminar at University of Pavia and to the 10th Annual International Industrial Organization Conference in Boston. An earlier version of this paper was circulated under the title *"Hidden Action or Hidden Information? How Information Gathering Shapes Contract Design"*. The comments of four referees and the associate editor were instrumental in helping us reshape our ideas and change accordingly this title. All remaining errors are ours.

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[1] This author wishes to thank financial support from the University of Padua, Grant No. CPDA121089/12.

[2] This author wishes to thank financial support from the program Investissements d'Avenir of the French government (ANR-10-LABX-93-01).

[3] Arrow (1986) and Hart and Holmström (1987) offer early important overviews while Laffont and Martimort (2002, Chapter 1) offer a historical perspective.

http://dx.doi.org/10.1016/j.geb.2015.03.014
0899-8256/

Contracting frictions. We consider a principal (referred to as *she* in the sequel) who hires an agent (*he*) to gather information which is relevant for a productive task he exerts on her behalf. Output depends not only on the agent's operating effort but also on a productivity shock. Learning the value of that shock is costly even though the value of information is positive; the agent's effort at the operating stage should indeed be tailored to the exact value of that shock.

This contractual relationship is *a priori* plagued with several frictions that are associated to various sorts of asymmetric information occurring during the course of contracting. First, *ex ante moral hazard* arises when the agent's effort in gathering information remains non-verifiable. Second, this information gathering technology is imperfect; the agent only gets *ex post private information* on productivity shocks with a probability which increases with his *ex ante* effort. Lastly, *ex post moral hazard* also arises when the agent's effort at the operating stage remains non-verifiable. In such context, neither can the principal infer whether a good performance comes from the agent having exerted a high operating effort or from a favorable productivity shock, nor can she ascertain whether this shock was known by the agent when he chose his operating effort.[4]

Finally, and this is a key ingredient of our modeling, the principal and the agent have different subjective beliefs on the outcome of information gathering. More precisely, the agent is more pessimistic than the principal on the likelihood that he will get informed.[5] There are several motivations behind such assumption.[6] First, the principal and the agent may just have different beliefs as a result of differences in learning on the likelihood of being informed. Overly optimistic agents might not have been tough enough in selecting projects in the past and may have been fired from the organization. Entrepreneurs and CEOs may be more optimistic than their subordinates on the likelihood of unveiling the profitability of new projects, or on the possibility to identify opportunities for new investments. Instead, agents may want to keep more pessimistic stances so as to preserve the quasi-rent they may hold under the status quo. Second, and even if our modeling preserves payoffs linearity, this assumption can be viewed as a reduced form for modeling the agent's risk aversion. An agent might be reluctant to operate under contracts that would tailor too precisely his performances to his claims on shocks that he might have learned. He might instead preferred contracts that make no use of such information and leave him with a less risky payoff.[7] Finally, the agent may need to raise funds to finance his investment in information gathering. *Ex post* private information on productivity shocks might create an agency problem with outside financiers who want to recoup their investments out of the proceeds kept by the agent. The impact of such agency cost (again in reduced form) is akin to reducing the value of getting informed.[8]

Contracting distortions. To see why a difference in beliefs generates agency costs, consider first the benchmark scenario where the agent and the principal actually have common beliefs. As contracting takes place *ex ante*, a simple fixed-price contract would make the agent residual claimant. Leaving all proceeds from production to the agent would be enough to induce efficient efforts, not only at the operating stage but also when gathering information. All the surplus could then be pocketed by the principal through a fixed fee. Agency costs are null under those circumstances.

When beliefs differ, the principal finds it costly to induce the right amount of information gathering. Part of the incentives is dissipated by the agent's pessimism. A pessimistic agent must thus be compensated with an extra *belief premium* that increases with his effort in information gathering. Agency costs now matter and reducing those costs calls for reducing that effort.

When gathering information is itself verifiable, the second-best effort that the principal would like to implement is even more distorted below what the agent would choose when being residual claimant (Proposition 1); a pessimistic agent would gather too much information. As a result, the second-best amount of information gathering is obtained by increasing the fixed repayment paid by the agent to the principal when he gets informed.

Even if it is attractive because it introduces a dichotomy between *ex ante* and *ex post* incentives, a menu of fixed-price contracts, with repayments that would be contingent on whether information has been gathered or not, is not always feasible. Indeed, under many circumstances where the agent's expertise is called for, his principal is neither able to ascertain whether information has ever been collected, nor what kind of information has been learned if any. *De facto*, tailoring repayments to whether information gathering has succeeded or not is impossible.

In the more likely, albeit more complex, scenario where neither information collection nor productivity shocks are common knowledge and verifiable, contracts must thus not only induce the right *ex ante* effort in information gathering but also force the agent to reveal whether he has observed the productivity shock and its possible value.[9] For sure, leaving all proceeds of production to the agent would mean paying too high a belief premium and this cannot be optimal. Of course,

[4] The agency model we consider thus belongs to the class of so-called "mixed models" which combine elements of moral hazard and asymmetric information. That an observable performance blends the impact of effort and an innate parameter is a familiar modeling trick of the scenting literature that goes back to Mirrlees (1971)'s seminal model of optimal income taxation and Laffont and Tirole (1986)'s well known model of incentive regulation. Laffont and Martimort (2002, Chapter 7) offers a typology of those and other related models.

[5] Section 5.2 briefly addresses the polar case of an agent who is more optimistic than the principal.

[6] Contracting problems between a principal and an agent with different risk perceptions have been studied in other contexts by De la Rosa (2011), Jeleva and Villeneuve (2004), Villeneuve (2005), Eliaz and Spiegler (2008), Spinnewijn (2013) and Grubb (2009).

[7] Section 5.3 briefly addresses an extension of our modeling where risk aversion is more explicit.

[8] See Guriev (2001) for an interesting model along these lines.

[9] Our analysis will illustrate that, in many respects, this multi-dimensional screening problem is much easier to handle than in the standard screening framework developed for multiproduct monopolists by Rochet and Choné (1998) among others.