Ex post information rents in sequential screening ☆

Daniel Krähmer [a], Roland Strausz [b],*

[a] *University Bonn, Department of Economics, Institute for Microeconomics, Adenauer Allee 24-42, D-53113 Bonn, Germany*
[b] *Humboldt-Universität zu Berlin, Institute for Economic Theory 1, Spandauer Str. 1, D-10178 Berlin, Germany*

A R T I C L E   I N F O

A B S T R A C T

We study ex post information rents in sequential screening models where the agent receives private ex ante and ex post information. The principal has to pay ex post information rents for preventing the agent to coordinate lies about his ex ante and ex post information. When the agent's ex ante information is discrete, these rents are positive, whereas they are zero in continuous models. Consequently, full disclosure of ex post information is generally suboptimal. Optimal disclosure rules trade off the benefits from adapting the allocation to better information against the effect that more information aggravates truth-telling.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

Economic theory recognizes that private information is a crucial determinant of economic inefficiencies. In adverse selection models where a principal faces a privately informed agent at the contracting stage, such as in monopolistic price discrimination (e.g. Baron and Myerson, 1982) or public procurement (e.g. Laffont and Tirole, 1986), the agent's private information forces the seller to concede information rents to the agent. As a result, a trade-off between rent extraction and efficiency emerges which leads to economic inefficiencies.

In contrast, Harris and Raviv (1978) show that, when the agent's private information arrives only ex post, after the agent's decision to participate in the relationship, this trade-off between rent extraction and efficiency does not emerge: the principal can extract the full surplus from the relation without leaving rents to the agent.[1] Esö and Szentes (2007a, 2007b) extend this result to a framework where the agent receives both ex ante and ex post private information. In particular, they decompose the agent's final information into a piece that arrives ex ante and a piece that arrives ex post and is independent of the ex ante information. This formulation identifies the agent's ex post information with the additional information, also referred to as the "shock", that he receives beyond the information he already has ex ante. In this setting, Esö and Szentes (2007a, 2007b) show that at the optimal mechanism, the agent's private knowledge of the shock does not add to the

---

[1] This holds in a framework with quasi-linear preferences where the agent is effectively risk-neutral.

information rents that he receives already from his ex ante information.[2] These results suggest the general insight that only ex ante private information is a source of information rents, whereas ex post private information is not.

The purpose of this paper is to qualify this view and to offer a more comprehensive perspective of the role of private ex post information in dynamic adverse selection problems. Our main contribution is to show that the insight of Harris and Raviv (1978) that the principal can extract all rents from ex post private information extends only to models in which the agent's ex ante private information is smooth and continuous such as Esö and Szentes (2007a, 2007b). In contrast, the principal has to concede a strictly positive information rent for extracting the agent's ex post information when the agent's ex ante private information is discrete. In order to demonstrate this result, we provide a formal decomposition of the agent's total information rents into a part that accrues from his ex ante information and a part that accrues from the privacy of the shock. Using this decomposition, we show that, in general, the seller has to concede to the agent additional rents for eliciting the shock, because the agent may benefit from *coordinating* lies about his ex ante information with lies about the realization of the shock. We show, however, that when the distance between ex ante types diminishes, the agent's potential benefits from coordinating his lies tend to zero at a faster speed than the distance between ex ante types. As a result, marginal ex post information rents vanish in the limit of a smooth continuous model.[3]

We further show that, as an implication of our result, full disclosure of the shock is no longer generally optimal when the agent's ex ante private information is discrete, whereas, as shown by Esö and Szentes (2007a, 2007b), full disclosure is optimal in continuous models. We identify two conflicting effects of disclosure. More disclosure is beneficial to the principal because it allows him to choose among a larger set of allocations, as allocations can indirectly depend on the agent's message about the disclosed information. The negative effect of more disclosure is however that, as already noted in Myerson (1991, p. 297), "revealing more information to players makes it harder to prevent them from finding ways to gain by lying". The seller's optimal disclosure rule trades off these two effects.

This paper contributes to the literature on dynamic mechanism design by focusing on the role of dynamic private information.[4] We built on Esö and Szentes' (2007a, 2007b) approach to study the relevance of ex post information in models with both discrete and continuous ex ante information. Next to demonstrating the relevance of ex post information in discrete models, we provide an alternative proof for their result that ex post information is irrelevant in continuous models.

Two recent papers are closely related to our partial disclosure result. First, also Li and Shi (2013) present a partial disclosure result for the standard sequential screening model. The key conceptual difference between our and their result is that Li and Shi (2013) consider more general disclosure rules. In their framework the seller can disclose any information about the *final* payoff type, which is a combination of both the buyer's initial private information and the shock. In contrast, we allow partial disclosure only of the shock. The results of Esö and Szentes (2007a) imply that with continuous type distributions, partial disclosure of the shock is never strictly optimal. Hence, whereas we show that this is no longer true with discrete types, Li and Shi (2013) show that partial disclosure may be strictly optimal if it concerns the final payoff type rather than the shock.

Second, Bergemann and Wambach (2013) provide an additional reason why partial disclosure might be optimal. They show for the setting of Esö and Szentes (2007a) that by only partially disclosing the additional information, i.e., the shock, the seller can relax participation constraints without impairing revenue. Hence, if the buyer must not make losses, conditional on the additional information disclosed, partial disclosure of the shock is optimal. In contrast, in our setting partial disclosure may be optimal even though the buyer can make losses ex post, after additional information has been disclosed.

The rest of the paper is organized as follows. We introduce the formal model in the next section. In Section 3, we set up the seller's problem for the case where the agent's ex post information is private and public and discuss how these two problems relate to the question of ex post information rents. In Section 4, we study ex post information rents, distinguishing between smooth continuous models, where the ex post information rent vanishes, and discrete models, where it does not. In Section 5 we explain with an explicit example that the seller is strictly better off by disclosing ex post information only partially rather than fully. Section 6 concludes. All proofs are relegated to Appendix A.

2. The model

There is a seller (she) and a buyer (he). The seller's costs to produce the good are commonly known and normalized to zero. The buyer's valuation is v and takes values in $[\underline{v}, \overline{v}]$. The terms of trade are the probability with which the good is sold, $x \in [0, 1]$, and a payment $t \in \mathbb{R}$ from the buyer to the seller. Parties are risk-neutral and have quasi-linear utility functions. That is, under the terms of trade x and t, the seller receives utility t, and the buyer receives utility $vx - t$. The seller's objective is to design a selling mechanism that maximizes her expected revenue where a selling mechanism specifies the terms of trade, possibly contingent on communication between the parties.

---

[2] This is shown in a setting with two periods and one allocation decision for a single agent by Esö and Szentes (2007a) and for the case with many agents by Esö and Szentes (2007b). Esö and Szentes (2013) generalize the result to a setting with allocation decisions in multiple periods and moral hazard.

[3] That information rents are zero in smooth continuous models is a consequence of the dynamic revenue equivalence property established in Pavan et al. (2014). When ex ante information is discrete, revenue equivalence fails, opening the door for the possibility that the agent gains from a lie about the shock after an initial lie.

[4] E.g., Baron and Besanko (1984), Courty and Li (2000), Battaglini (2005), Esö and Szentes (2007a, 2007b), Hoffmann and Inderst (2011), Krähmer and Strausz (2011), Nocke et al. (2011), Pavan et al. (2014), Boleslavsky and Said (2013), Deb and Said (2013).