Knowing your Lemon before you Dump It*

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Abstract

We study Stackelberg games where a leader covertly acquires information before engaging with a follower. Her decision to engage affects the follower's beliefs, shaping outcomes in adverse selection environments like trade, disclosure, and entry. We identify conditions under which the leader values information more when the follower expects her to be better informed, affecting equilibrium multiplicity, disclosure incentives, and expectation traps, and justifying stronger policy interventions, such as subsidies, to improve welfare. Extending the analysis to fully flexible information choice, we demonstrate the robustness of the key insights and uncover novel market breakdowns, where trade collapses despite no information acquisition.

Keywords: Endogenous adverse selection, generalized lemons (and anti lemons) problem, expectation traps, optimal policy, flexible information.

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1 Introduction

Many strategic interactions can be modeled as Stackelberg games in which a leader (player L, "she") chooses between an adverse-selection-sensitive action and an adverse-selection-insensitive one. The response by a follower (player F, "he") to the adverse-selection-sensitive action depends on his beliefs about L's motives. For instance, in the Akerlof lemons model, a seller (L) chooses between trading with a buyer (F) or opting out; the buyer's offer to the seller depends on his beliefs about what information privately held by the seller motivated her to put the asset on sale. More generally, the adverse-selection-insensitive action may still trigger a response—for example, disclosing hard information that fully reveals the asset's value leads F to a belief-invariant price. The key assumption is that information inducing L to choose the adverse-selection-sensitive action (e.g., withholding disclosure) worsens F's response. This structure appears in canonical models of trade, disclosure, entry, and partnership central in Industrial Organization, Finance, and Organizational Economics.[1]

We enrich the classic model by allowing player L to covertly acquire information (e.g., about the asset's value) before deciding whether to engage. Our focus is on how this information choice responds to player F's expectations—capturing how strategic considerations shape the value of information in these games. To put flesh on the characterization, we start by comparing information structures through the mean-preserving-spread (MPS) order, or the more refined rotations order, but then generalize the analysis to fully flexible information. We identify primitive conditions for expectation conformity (EC)—that is, for player L to find information more valuable when player F expects her to acquire it. We show that EC arises when (a) more information aggravates the adverse selection problem, and (b) a reaction by F less favorable to L raises L's value for information; or both conditions are simultaneously reversed. The condition for EC is easier to check than verifying directly that EC prevails. It obtains,

[1]The Supplement also discusses anti-lemons environments—where L's choice to engage signals good news for F, prompting a more favorable response—as in Spence's (1973) signaling model.

for example, when, holding player F's reaction fixed, a more informative experiment reduces the probability of trade, both when such a probability is computed by player L, given her actual choice of experiment, and by player F, given the experiment that he expects player L to choose. EC typically holds when player L derives a larger payoff from interating with player F, holding the latter's reaction fixed.

Beyond being of intrinsic interest, EC plays a key role in equilibrium analysis and has significant policy implications. It often underlies equilibrium multiplicity, leading to sharp shifts in market behavior—for instance, from frequent trading with little asset scrutiny to infrequent trading with heavy scrutiny. It generates multiplier effects, where small parameter changes yield large outcome shifts. It influences the benefits of hard information disclosure, used for example to demonstrate one's investment in learning asset values. Finally, it underpins the risk of expectation traps, where players suffer from being expected to be better informed—lowering payoffs even when information is cheap.

These features motivate policy interventions. We identify conditions under which subsidizing trade is optimal, and show that, when properly designed, such interventions yield a double dividend: they discourage information acquisition, thereby facilitating trade and further enhancing welfare. Thus, endogenous information calls for stronger interventions (e.g., larger subsidies or more generous asset buyback programs) than in models with exogenous information.

In the second part of the paper, we consider flexible information choice. The purpose of the extension is threefold. First, it establishes the robustness of the key insights (in particular those about EC). Second, it introduces an alternative order over L's investments when the experiments themselves are not ordered. Third, it uncovers a novel form of market breakdown where trade does not occur, despite L not acquiring any information and both players recognizing the gains from trade. We show that, under the entropy cost typically considered in the literature, these equilibria exist despite the fact that the marginal cost vanishes when the optimal signal recommends trading for a small, vanishing set of fundamentals. The reason is that the benefit of

these signals also vanishes, with the benefit vanishing faster than the cost. Furthermore, these equilibria survive D1 and most other forward-induction refinements.

Organization. Section 2 contains the model and defines a broad class of generalized lemons environments. Section 3 introduces the notion of EC. Section 4 focuses on three topics closely-related to EC: expectation traps, disclosure (of hard information), and cognitive styles. Section 5 contains policy analysis. Section 6 considers flexible information choice. Section 7 concludes. All proofs are in the Appendix. The Supplement contains various examples of generalized lemons and anti-lemons problems, discusses how the results flip in the anti-lemons case, relates the analysis to other covert investment games, and contains additional results for the Akerlof model with flexible information under entropy cost.

Related Literature. This paper relates to several strands of the literature. First, it contributes to the study of the lemons problem under alternative information structures. Kartik and Zhong (2024) analyze bilateral trade and characterize equilibrium payoffs under general information structures, allowing either player to be partially informed.[2] Related contributions include Levin (2001), Kessler (2001), and Bar-Isaac et al. (2018), which examine how payoffs, trade volume, and efficiency vary with the information structure in Akerlof-type settings. In contrast, our focus is on: (a) how information acquisition is shaped by other players' expectations; (b) how these expectations depend on the impact of information on adverse selection; (c) the possibility of expectation traps; (d) the double dividend of policy interventions that both alleviate adverse selection and discourage inefficient information acquisition; and (e) the robustness of these insights to fully flexible information choice.

In a two-state environment with fully revealing signals, Dang (2008) identifies conditions under which, in equilibrium, no information is acquired and trade does not occur, as well as conditions under which the informed player earns surplus despite

[2]Their analysis generalizes Bergemann, Brooks, and Morris (2015) by relaxing the assumptions that (a) buyers are fully informed, and (b) values are private.

lacking bargaining power.[3] Lichtig and Weksler (2023) study a setting where the seller can costlessly choose from a finite set of experiments ranked by the strict location-independent risk order, and show that the seller always selects the riskiest experiment. Thereze (2023) studies how information costs shape demand elasticity and market outcomes in a competitive insurance market, assuming agents acquire information after seeing prices. Madarasz and Pycia (2025) consider a class of bargaining games in which the informed player knows their preferences, the experiment and its outcome are public, and the receiver holds full bargaining power. Under these conditions, they show that only the cheapest experiments are used in equilibrium, regardless of content. None of these works investigates the determinants of EC, the relationship of the latter with the determinacy of equilibria, the possibility of expectation traps, and the social value of taxing/subsidizing interactions, which are the focus of the present paper.

A complementary literature examines information acquisition under private values. For example, Ravid (2020) analyzes a repeated bargaining game with a rationally inattentive buyer, while Ravid, Roesler, and Szentes (2022) study equilibrium properties of a one-shot ultimatum game as the buyer's cost of information vanishes. In contrast, our analysis investigates how information shapes adverse selection, and highlights how EC can give rise to expectation traps where the information-acquiring player can be strictly worse off in a high-information-intensity equilibrium despite the cost of information vanishing and the follower not having bargaining power.

Pavan and Tirole (2024) study the welfare effects of mandatory disclosure under contract renegotiation. The present paper, instead, focuses on the effects of information on adverse selection and on policy interventions aimed at alleviating it. Expectation conformity is also studied in Pavan and Tirole (2023) but in a setting without adverse

[3]The market breakdown equilibrium in Section 6 shares with Dang (2008) the fact that trade does not occur despite L not acquiring information. In Dang (2008), however, the seller's choice is between no information and a fully-revealing signal with fixed cost, whereas in Section 6 information is flexible and the cost of information is related to entropy reduction. Under such a specification, the marginal cost of information vanishes when the signal recommends trading for a vanishing set of fundamentals. Despite this property, the seller optimally refrains from acquiring *any* signal when the buyer, expecting no trade, offers a low price.

selection; none of the results in the present paper have counterparts in those papers.

Finally, our discussion of how government interventions can enhance the efficiency of markets plagued by adverse selection connects to Philippon and Skreta (2012) and Tirole (2012). In those papers, sellers' information is exogenous. By contrast, Section 5 of the present paper explores how policy design should adjust to account for endogenous information. In this respect, our work is also related to Colombo, Femminis, and Pavan (2025), and Pavan, Sundaresan, and Vives (2025). The former studies optimal policy in economies with investment complementarities and endogenous private information, while the latter analyzes government interventions in financial markets where traders acquire private information before submitting limit orders. Relatedly, Koenig and Pothier (2022) investigate how certain central bank interventions and macroprudential regulations shape the incentives of fund managers to gather information, thereby influencing the risk of redemption runs or inefficient liquidity dry-ups driven by self-fulfilling fears.

2 Model

Consider the following game between a "leader" (L, she) and a "follower" (F, he).

(a) Actions and timing

Player L covertly acquires information about a state of Nature by selecting an experiment and observing its realization. Based on her posterior beliefs, she chooses an action $a \in \{0, 1\}$. Player F observes action a, but not the experiment selected by L or its outcome, and then chooses a response. Action $a = 0$ is adverse-selection-insensitive, meaning F's response to it does not depend on his beliefs about L's experiment and its outcome. This occurs, for example, when $a = 0$ represents not offering the asset for sale, or disclosing hard information that certifies its value. Because such a response plays no role, we omit its description.[4] Action $a = 1$, instead, is adverse-selection-

[4]In the Supplement, we discuss how the results may accommodate for the possibility that F's reaction to $a = 0$ also depends on F's beliefs about ρ and m, but with a lower sensitivity to these variables than F's reaction to $a = 1$

sensitive. We denote by $r \in \mathbb{R}$ F's reaction to it, with higher r representing a friendlier reaction (player L's utility is increasing in r, as explained below).[5]

(b) Information

The state of Nature, denoted by $\omega \in (-\infty, +\infty)$ (e.g., asset quality in Akerlof (1970) model), is commonly believed to be drawn from a distribution G with prior mean ω_0. Both players have preferences affine in ω, so their payoffs depend only on the posterior mean m. An experiment, indexed by $\rho \in \mathbb{R}_+$, is represented by a cumulative distribution function $G(\cdot;\rho)$ for the posterior mean m, satisfying the martingale property $\int_{-\infty}^{+\infty} m dG(m;\rho) = \omega_0$. Player L can choose from a continuum of experiments, indexed by $\rho \in [0, \bar{\rho}]$, with $\bar{\rho} \in \mathbb{R}_+$. For tractability, we assume the function family $\{G(\cdot;\cdot)\}$ is differentiable and equi-Lipschitz continuous in ρ with each derivative $G_\rho(m;\rho) \equiv \partial G(m;\rho)/\partial\rho$ integrable in m.[6] For most of the results, we will also assume that the function family $\{G(\cdot;\cdot)\}$ is consistent with the *mean-preserving-spread* (MPS) order.

Assumption 1 (***MPS***)**.** *The set of experiments $\{G(\cdot;\cdot)\}$ is consistent with the MPS order if, for any ρ and $\rho' > \rho$, any $m^* \in \mathbb{R}$, $\int_{-\infty}^{m^*} G(m;\rho')dm \geq \int_{-\infty}^{m^*} G(m;\rho)dm$, with $\int_{-\infty}^{+\infty} G(m;\rho')dm = \int_{-\infty}^{+\infty} G(m;\rho)dm$.*

Some of the results below assume a strengthening of such an order whereby the spreads correspond to "rotations." (see, e.g., Diamond and Stiglitz (1974) and Johnston and Myatt (2006)):

Definition 1 (**rotations**)**.** *The set of information structures $\{G(\cdot;\cdot)\}$ is consistent with the rotation order if, for any ρ, there exists a rotation point m_ρ such that $G_\rho(m;\rho) \geq 0$ for $-\infty < m \leq m_\rho$ and $G_\rho(m;\rho) \leq 0$ for $m_\rho \leq m < +\infty$ (with some inequalities strict).*

[5]Throughout, "increasing" and "decreasing" refer to strictly monotonic functions. "Non-increasing" and "non-decreasing" refer to weakly monotonic functions.

[6]Together with Assumption 2, these assumptions permit us to describe some of the key conditions in a concise form and use the envelope theorem (e.g., Milgrom and Segal (2002)) for one of our results. None of the qualitative insights hinge on these differentiability assumptions.

As is well known any mean-preserving spread can be obtained through a sequence of rotations.

Example (**non-directed search**). *Player L learns the true state ω with probability $\rho \in [0,1]$ and nothing with probability $1-\rho$. Then, $G(m;\rho) = \rho G(m)$ for $m < \omega_0$ and $G(m;\rho) = \rho G(m) + 1 - \rho$ for $m \geq \omega_0$. In this example $m_\rho = \omega_0$ for all ρ.*

Another example of rotations is when the state ω is normally distributed and the signal is normally distributed around the true state, with ρ capturing the signal's precision. Additional examples are provided in Proposition 1.

Cost of information. Choosing information ρ costs $C(\rho)$ to player L, with C non-decreasing, differentiable, and weakly convex.

(c) Preferences

Leader. Let $\delta_L(r,\, m) \equiv u_L(1,\, r,\, m) - u_L(0,\, m)$ denote L's payoff differential between $a = 1$ and $a = 0$ when F's reaction to $a = 1$ is r and L's posterior mean is m.[7] This payoff is gross of the cost of information. The net payoff is $\delta_L - C(\rho)$. We assume δ_L satisfies the following assumption:

Assumption 2 (***leader's preferences***). *L's payoff differential δ_L is Lipschitz continuous and twice continuously differentiable in each argument, increasing in r, decreasing in m, and such that, for any (r,m), $\frac{\partial^2}{\partial r \partial m}\delta_L(r,m) \geq 0$.*

The assumption that δ_L is increasing in r permits us to interpret a larger r as a friendlier reaction by player F to L's decision to engage. The monotonicity of δ_L in m in turn implies that, no matter ρ, when expecting a reaction r by F, player L optimally engages if and only if $m \leq m^*(r)$, with $m^*(r)$ solving $\delta_L(r,\, m^*(r)) = 0$. Finally, the assumption that δ_L has a non-negative cross-partial derivative means that the marginal benefit of a friendlier response is greater in states where L's incentives to engage are weaker. This condition plays a role in determining whether information becomes more attractive to L when F reacts more favorably (see Proposition 1 below).

[7] Because L's payoff is affine in ω, $\delta_L(r,\, m)$ is also the payoff differential when the state is $\omega = m$.

Follower. Let $u_F(1, r, \omega)$ denote F's payoff when L chooses action $a = 1$, F responds with r, and the state is ω. As mentioned above, a key assumption for tractability is that u_F is affine in ω.

(d) Lemons

Consider a fictitious game in which L's information is exogenously fixed at $\rho^\dagger$. We assume that, for any $\rho^\dagger$, the equilibrium of this fictitious game is essentially unique. Let $a^*(\cdot; \rho^\dagger)$ and $r(\rho^\dagger)$ denote, respectively, L's engagement strategy and F's reaction to $a = 1$ in equilibrium. For any m, $a^*(m; \rho^\dagger) \in [0, 1]$ is the probability that L engages when her posterior mean is m.[8] In the game with endogenous information, we assume that if F expects L to choose $\rho^\dagger$, he also expects her to engage according to $a^*(\cdot; \rho^\dagger)$.

Let

$$M^-(m^*;\, \rho^\dagger) \equiv \mathbb{E}_{G(\cdot;\, \rho^\dagger)}[m | m \leq m^*] = m^* - \frac{1}{G(m^*; \rho^\dagger)} \int_{-\infty}^{m^*} G(m; \rho^\dagger) dm \qquad (1)$$

denote the truncated mean of the distribution $G(\cdot;\, \rho^\dagger)$ of m, under information $\rho^\dagger$. Because, in equilibrium, L engages if and only if $m \leq m^*(r(\rho^\dagger))$, an increase in M^- can be viewed as a reduction of the adverse selection problem.

Definition 2 (**impact of information on adverse selection**)**.** *Suppose that, for any $\rho^\dagger$, the equilibrium of the fictitious game in which ρ is exogenously fixed at $\rho^\dagger$ is essentially unique. Starting from $\rho^\dagger$, an increase in information by player L aggravates (respectively, alleviates) adverse selection if $\frac{\partial}{\partial \rho^\dagger} M^-(m^*(r(\rho^\dagger));\, \rho^\dagger) < 0$ (respectively, if $\frac{\partial}{\partial \rho^\dagger} M^-(m^*(r(\rho^\dagger));\, \rho^\dagger) > 0$).*[9]

Assumption 3 (***lemons***)**.** *For any $\rho^\dagger$, the equilibrium of the fictitious game in which ρ is exogenously fixed at $\rho^\dagger$ is essentially unique and is such that the friendliness of F's reaction increases with L's information $\rho^\dagger$ if and only if more information alleviates*

[8] When we say that the equilibrium is "essentially unique," we mean that the value of $r(\rho^\dagger)$ is unique and that $a^*(m; \rho^\dagger)$ is unique except for $m = m^*(r(\rho^\dagger))$.

[9] The notation $\frac{\partial}{\partial \rho^\dagger} M^-\big(m^*(r(\rho^\dagger));\, \rho^\dagger\big) \equiv \frac{\partial}{\partial \rho^\dagger} M^-(m^*;\, \rho^\dagger)\Big|_{m^* = m^*(r(\rho^\dagger))}$ refers to the partial derivative of $M^-(m^*;\, \rho^\dagger)$ with respect to $\rho^\dagger$ evaluated at $m^* = m^*\big(r(\rho^\dagger)\big)$.

the adverse selection problem: $\frac{dr(\rho^\dagger)}{d\rho^\dagger} \overset{\text{sgn}}{=} \frac{\partial}{\partial \rho^\dagger} M^-\big(m^*(r(\rho^\dagger)); \rho^\dagger\big)$.

In the Supplement, we show how a number of games of interest fit into the general framework introduced above. In the main text, we will consider primarily the following specification:

Akerlof Model

In Akerlof (1970), L is a seller of an indivisible asset that can be put on sale ($a = 1$) or kept by L for own consumption ($a = 0$). Player F is a representative of a group of competitive buyers. L's value for the asset is ω whereas F's value is $\omega+\Delta$, where $\Delta > 0$ parametrizes the gains from trade. The price $r(\rho^\dagger)$ offered by F when L's information is $\rho^\dagger$ is then given by the solution to the following equation

$$r = M^-(r; \rho^\dagger) + \Delta, \tag{2}$$

reflecting the fact that the cutoff $m^*(r)$ for L's engagement is r. Consistently with what was explained above, we assume that the solution to (2) is unique, which is the case, for example, when $G(\cdot; \rho^\dagger)$ is absolutely continuous over $\mathbb{R}$ with density $g(\cdot; \rho^\dagger)$ strictly positive over $[\underline{m}(\rho), \bar{m}(\rho)]$, and the inverse hazard rate $G(\cdot; \rho^\dagger)/g(\cdot; \rho^\dagger)$ is increasing over $[\underline{m}(\rho), \bar{m}(\rho)]$. Assumption 3 is then satisfied. So is Assumption 2, given that, in this application, $\delta_L(r, m) = r - m$.

3 Expectation Conformity

We now investigate how L's choice of information is influenced by F's expectations and how the latter in turn depend on whether information aggravates adverse selection.

Simple computations show that, for any information $\rho^\dagger$ and truncation point m^*,

$$\frac{\partial}{\partial \rho^\dagger} M^-(m^*; \rho^\dagger) \overset{\text{sgn}}{=} A(m^*; \rho^\dagger) \tag{3}$$

where

$$A(m^*;\rho^\dagger) \equiv \left[m^* - M^-(m^*;\,\rho^\dagger)\right] G_\rho(m^*;\rho^\dagger) - \int_{-\infty}^{m^*} G_\rho(m;\rho^\dagger)dm. \tag{4}$$

The first term of A captures the effect of a change in L's engagement on F's expectation of the state: more information aggravates adverse selection when it reduces the chances L engages (i.e., when $G_\rho(m^*;\rho^\dagger) < 0$). The second term of A in turn is related to the effect of information on the dispersion of L's posterior mean m. When more information induces more dispersion in the sense of second-order stochastic dominance (which is always the case when experiments are ranked in the MPS order), this second effect unambiguously contributes to an aggravation of the adverse selection problem. Hereafter, we will refer to

$$\mathrm{A}(\rho^\dagger) \equiv A(m^*(r(\rho^\dagger));\rho^\dagger) \tag{5}$$

as the "*adverse-selection effect*" of an increase of information at $\rho^\dagger$. Note that, under Assumption 3, when $A(\rho^\dagger) > 0$ (alternatively, $A(\rho^\dagger) < 0$), starting from $\rho^\dagger$ a small increase in the informativeness of L's experiment triggers a friendlier (alternatively, an unfriendlier) reaction by F.

Next let $\Pi(\rho;r) \equiv \sup_{a(\cdot)} \left\{U_L(0) + \int_{-\infty}^{+\infty} a(m)\,\delta_L(r,m)dG(m;\rho)\right\}$ denote L's ex-ante payoff (gross of the information cost) from choosing ρ when expecting F to react with r to her decision to engage, where $U_L(0)$ is L's ex-ante expected payoff when she never engages, and $a(m)$ is the probability that L engages when her posterior mean is m. Then let $B(\rho;\rho^\dagger) \equiv -\partial^2\Pi(\rho;r(\rho^\dagger))/\partial\rho\partial r$ denote the effect of a reduction in the friendliness of F's reaction, starting from $r = r(\rho^\dagger)$, on L's marginal value of information, evaluated at ρ.[10] Hereafter, we will refer to $B(\rho;\rho^\dagger)$ as the "*benefit of a friendlier reaction effect*".

Definition 3 (**information incentive effect of unfriendlier reactions**). *Given $(\rho,\rho^\dagger)$, a marginal reduction in the friendliness of player F's reaction starting from $r = r(\rho^\dagger)$, raises (respectively, lowers) player L's marginal benefit to invest in information at ρ if*

[10] Consistently with the notation above, $\partial^2\Pi(\rho;r(\rho^\dagger))/\partial\rho\partial r$ is the cross derivative of $\Pi(\rho;r)$ evaluated at an arbitrary ρ and at $r = r(\rho^\dagger)$.

$B(\rho;\rho^\dagger) > 0$ *(respectively, if* $B(\rho;\rho^\dagger) < 0$*).*

Using the envelope theorem along with the fact that, for any ρ, the optimal engagement strategy for L when F expects information $\rho^\dagger$ is to engage if and only if $m \leq m^*(r(\rho^\dagger))$, we have that[11]

$$\begin{aligned} B(\rho;\rho^\dagger) &= -\frac{\partial \delta_L(r(\rho^\dagger), m^*(r(\rho^\dagger)))}{\partial r} G_\rho\Big(m^*(r(\rho^\dagger));\rho\Big) \\ &\quad + \int_{-\infty}^{m^*(r(\rho^\dagger))} \frac{\partial^2 \delta_L(r(\rho^\dagger), m)}{\partial r \partial m} G_\rho(m;\rho) dm. \end{aligned} \tag{6}$$

Under Assumption 2, the marginal benefit of a friendlier reaction by player F is non-decreasing in the posterior mean m. As a result, the second term of $B(\rho;\rho^\dagger)$ is always positive when a higher ρ indexes a mean-preserving spread of the induced posterior mean. Because δ_L is increasing in r, the sign of the first term of $B(\rho;\rho^\dagger)$, instead, is determined by whether an increase in information increases or reduces the chances that player L engages.

Finally, let $V_L(\rho;\rho^\dagger) \equiv \Pi(\rho; r(\rho^\dagger))$ denote the maximal payoff that player L can obtain by choosing information ρ when player F expects information $\rho^\dagger$.

Definition 4 (**expectation conformity**)**.** *Expectation conformity (EC) holds at* $(\rho,\rho^\dagger)$ *if and only if* $\partial^2 V_L(\rho;\rho^\dagger)/\partial\rho\partial\rho^\dagger > 0$*.*

That EC holds at $(\rho,\rho^\dagger)$ thus means that the marginal value to L from choosing a more informative experiment starting from ρ is higher when F, starting from $\rho^\dagger$, expects a more informative experiment. When there is an interval $[\rho_1,\rho_2]$ such that the property holds for all $\rho,\rho^\dagger \in [\rho_1,\rho_2]$, the gross value to L from moving from ρ_1 to ρ_2 is higher when F expects ρ_2 than when he expects ρ_1: $V_L(\rho_2;\rho_2) - V_L(\rho_1;\rho_2) > V_L(\rho_2;\rho_1) - V_L(\rho_1;\rho_1)$. In this sense, EC captures a complementarity between actual and anticipated information choice. In the next section, we relate this property to the

[11] Again $\partial\delta_L(r(\rho^\dagger), m^*(r(\rho^\dagger)))/\partial r$ and $\partial^2\delta_L(r(\rho^\dagger), m^*(r(\rho^\dagger)))/\partial r\partial m$ are, respectively, the partial derivative of $\delta_L(r,m)$ with respect to r and the cross derivative of $\delta_L(r,m)$, evaluated at $r = r(\rho^\dagger)$ and $m = m^*(r(\rho^\dagger))$.

determinacy of equilibria and a few other phenomena of interest. Before doing so, we provide a characterization of EC.

Proposition 1 (***expectation conformity***)**.** *Suppose Assumptions 1, 2, and 3 hold.*
(i) EC holds at $(\rho, \rho^\dagger)$ *if and only if* $\mathrm{A}(\rho^\dagger)B(\rho;\rho^\dagger) < 0$.
(ii) Information aggravates adverse selection at $\rho^\dagger$ *(i.e.,* $\mathrm{A}(\rho^\dagger) < 0$*) when* $\{G(\cdot;\rho)\}$ *is a family of Uniform, Pareto, or Exponential distributions, or, when* $G_\rho(m^*(r(\rho^\dagger));\rho^\dagger) < 0$.
(iii) Starting from $r(\rho^\dagger)$*, a reduction in* r *raises* L*'s value of information at* ρ *(i.e.,* $B(\rho;\rho^\dagger) > 0$*) if* $G_\rho(m^*(r(\rho^\dagger));\rho) < 0$*. When* $\{G(\cdot;\rho)\}$ *is a family of Uniform, Pareto, or Exponential distributions, the condition holds when the engagement threshold exceeds the rotation point (i.e.,* $m^*\big(r(\rho^\dagger)\big) > m_\rho$*).*
(iv) Suppose that, for any m^**,* $M^-(m^*;\rho)$ *is decreasing in* ρ *(which is the case for Uniform, Pareto, and Exponential distributions), implying that, for any* $\rho^\dagger$*,* $\mathrm{A}(\rho^\dagger) < 0$*. If* $\partial^2\delta_L(r,m)/\partial r\partial m = 0$*, as in the Akerlof model, then* $G_\rho(m^*(r(\rho^\dagger));\rho) < 0$ *is a necessary and sufficient condition for EC at* $(\rho, \rho^\dagger)$*.*[12]

Hence, EC holds at $(\rho, \rho^\dagger)$ when the adverse selection effect and the benefit of a friendlier reaction effect are of opposite sign. In turn this happens when, fixing player F's reaction at $r(\rho^\dagger)$, an increase in the informativeness of player L's experiment decreases the probability that L engages, both when such an increase is evaluated from player L's perspective (i.e., starting from ρ) and when evaluated from player F's perspective (i.e., starting from $\rho^\dagger$)—formally, when

$$\max\left\{G_\rho(m^*(r(\rho^\dagger));\rho^\dagger), G_\rho(m^*(r(\rho^\dagger));\rho)\right\} < 0. \tag{7}$$

This is because, from F's perspective, that L engages less often (i.e., $G_\rho(m^*(r(\rho^\dagger));\rho^\dagger) < 0$) implies an aggravation in the adverse selection problem, which induces F to respond in an unfriendlier manner (part (ii) in the proposition). That F responds in an un-

[12] See also Examples (a), (c), and (d) in the Supplement for alternative games in which $\partial^2\delta_L(r,m)/\partial r\partial m = 0$.

friendlier manner, together with the fact that, in L's eyes, more information makes her engage less often (i.e., $G_\rho(m^*(r(\rho^\dagger));\rho) < 0$), implies a higher marginal value for L to acquire more information starting from ρ (part (iii) in the proposition).

Importantly, Condition (7) is sufficient for EC but not necessary. For example, when the family of distributions is Uniform, Pareto, or Exponential, more information always aggravates adverse selection, implying that EC holds at $(\rho, \rho^\dagger)$ if, and only if, in L's eyes, it reduces the probability of engagement (i.e., if $G_\rho(m^*(r(\rho^\dagger));\rho) < 0$), which is the case if and only if the engagement threshold exceeds the rotation point (i.e., $m^*\big(r(\rho^\dagger)\big) > m_\rho$). In the Akerlof model, this happens when the gains from trade, Δ, are large enough. When this is the case, EC holds at $(\rho, \rho^\dagger)$ irrespectively of whether, in F's eyes, more information increases or decreases the probability of engagement (i.e., irrespectively of the sign of $G_\rho(m^*(r(\rho^\dagger));\rho^\dagger)$).

EC also holds when information alleviates adverse selection (i.e., $\mathrm{A}(\rho^\dagger) > 0$) and a friendlier reaction by F raises L's marginal value of information (i.e., $B(\rho;\rho^\dagger) < 0$). As an illustration, consider again the Akerlof model (in which $\partial^2\delta_L(r,m)/\partial r\partial m = 0$). Use Conditions (1), (3), and (6) to verify that $\mathrm{A}(\rho^\dagger) > 0 > B(\rho;\rho^\dagger)$ when

$$\frac{\partial}{\partial\rho}\int_{-\infty}^{m^*(r(\rho^\dagger))} G(m;\rho)dm/[G(m^*(r(\rho^\dagger));\rho)\Big|_{\rho=\rho\dagger} < 0 < G_\rho(m^*(r(\rho^\dagger));\rho).$$

This is the case, for example, when m is drawn from $[0,1]$ according to the cdf $G(m;\rho) = m+\rho m(1-m)(2m-1)$, with $\rho \in [0,1]$, and Δ is large enough so that $m^*(r(\rho^\dagger)) > 1/2$.

3.1 Akerlof Model under Non-Directed Search

Under non-directed search, the rotation point is the prior mean. Part (iv) of Proposition 1 then says that EC holds at $(\rho, \rho^\dagger)$ if and only $r(\rho^\dagger) > \omega_0$. The following is then true:

Corollary 1 (***EC in Akerlof under non-directed search***)**.** *In the Akerlof model under non-directed search, EC holds at $(\rho, \rho^\dagger)$ if and only if the gains from trade Δ are sufficiently large (namely, the unique solution $r(\rho^\dagger)$ to $r = M^-(r;\rho^\dagger) + \Delta$ exceeds the*

prior mean ω_0).

To build intuition, recall that L puts the asset up for sale when $m \leq r(\rho^\dagger)$. When the gains from trade Δ are large, $r(\rho^\dagger) > \omega_0$. L is thus willing to engage both when uninformed and when learning that the asset's value is below the price. In this situation, F anticipates that if L were to acquire more information she would enter the market more selectively, lowering the asset's expected quality. Anticipating this adverse selection, F lowers the price. But then it becomes even more important for L to learn the asset's value. Thus, EC holds naturally in this case.

When, instead, Δ is small, $r(\rho^\dagger) < \omega_0$. Anticipating such a low price, L enters the market only if informed that $\omega \leq r(\rho^\dagger)$. The asset's expected value, conditional on being on the market, is thus invariant in the seller's information. As a result, variations in F's expectations of L's information have no effect on L's incentives to search.

3.2 Gains from Engagement

The example in the previous subsection suggests that EC is more likely to obtain when the gains from engagement are large. The next result shows that this is true more generally.

Proposition 2 (***gains from engagement***)**.** *Suppose Assumptions 1, 2 and 3 hold, and information structures are rotations as defined in Definition 1. Further assume that L's payoff differential takes the form $\delta_L(m, r) = \bar{\delta}_L(m, r) + \theta$, where $\bar{\delta}_L(m, r)$ satisfies Assumption 2, and $\theta \in \mathbb{R}$. Suppose EC holds at $(\rho, \rho^\dagger)$ when $\theta = \theta'$. Then it also holds at the same $(\rho, \rho^\dagger)$ for any $\theta'' > \theta'$.*

Consider again the Akerlof model in which $\bar{\delta}_L(m, r) = r - m$ but suppose now that trade is subsidized, with θ denoting the magnitude of the subsidy. The Proposition then says that if EC holds for small subsidies it also holds for larger ones.

Note that, holding player F's reaction fixed, larger gains from engagement reduce the marginal benefit of acquiring information under the sufficient condition for EC

identified in Proposition 1—namely, that more information reduces the probability of trade. Formally, for any (r, θ), let $m^*(r; \theta)$ denote the cut-off below which L engages when the gains from engagement are parametrized by θ and F's reaction is r. For any $(\rho^\dagger, \theta)$, then let $r(\rho^\dagger; \theta)$ denote F's unique equilibrium response when L's information is exogenously fixed at $\rho^\dagger$ and the gains from engagement are parametrized by θ. Then observe that

$$\frac{\partial^2}{\partial\theta\partial\rho}\left[\int_{-\infty}^{m^*(r(\rho^\dagger;\theta),\theta)}[\bar{\delta}_L(r(\rho^\dagger;\theta),m)+\theta]dG(m;\rho)\right] = G_\rho(m^*(r(\rho^\dagger;\theta),\theta);\rho).$$

This observation clarifies that it is not the direct effect of higher engagement gains that supports EC. Rather, EC arises because larger gains from engagement amplify the adverse selection concerns faced by F: anticipating that L will acquire more information, F reduces r more sharply. This, in turn, raises L's value of acquiring information, thereby inducing EC.

4 Expectation Traps, Disclosure, and Cognitive Style

We now turn to three phenomena that are intrinsically related to EC.

4.1 Expectation Traps

Proposition 3 (***expectation traps***)**.** *Suppose that Assumptions 1, 2, and 3 hold and that there exist ρ_1 and ρ_2, with $\rho_2 > \rho_1$, such that $G_\rho(m^*(r(\rho^\dagger)); \rho) < 0$ for all $\rho^\dagger, \rho \in [\rho_1, \rho_2]$, implying that EC holds for all $(\rho^\dagger, \rho) \in [\rho_1, \rho_2]^2$. There exist monotone and continuous cost functions $C(\cdot)$ such that ρ_1 and ρ_2 are both equilibrium levels. Furthermore, under any such cost functions, player L is better off in the low information-intensity equilibrium ρ_1.*

Expectation traps do not arise merely because, when C is increasing, L incurs higher costs in a high information-intensity equilibrium. At the margin, the additional cost of acquiring more information is exactly offset by the corresponding gain in decision

quality. Instead, expectation traps emerge because player F, anticipating a more severe adverse selection problem when player L acquires more information, responds less favorably. This unfriendlier reaction not only compels player L to indeed acquire more information—thereby confirming player F's expectation—but also lowers player L's payoff. To illustrate, consider again the Akerlof model under non-directed search of the previous section, and suppose that G is Uniform over $[0,1]$ and $\Delta \in (1/4, 1/2)$. For any $\rho^\dagger \in (0,1)$, F's equilibrium reaction is unique and given by $r(\rho^\dagger) = 1+\Delta-1/\rho^\dagger+\sqrt{1-\rho^\dagger+(\rho^\dagger\Delta)^2}/\rho^\dagger \in (\omega_0, 1)$, with $r(\rho^\dagger)$ decreasing in $\rho^\dagger$. Furthermore, for any $\rho^\dagger, \rho \in (0,1)$, $G_\rho(m^*(r(\rho^\dagger)); \rho) < 0$, implying that EC holds for any such pair of investments. Take any $\rho_1, \rho_2 \in (0,1)$, with $\rho_2 > \rho_1$, and any $c_1, c_2 \in \mathbb{R}_{++}$, such that (1) $c_1 \leq \rho_1[r(\rho_1)^2+1]/2+(1-\rho_1)r(\rho_1)$, (2) $c_2 \leq \rho_2[r(\rho_2)^2+1]/2+(1-\rho_2)r(\rho_2)$, and (3)

$$\frac{1}{2}(\rho_2-\rho_1)\left[r(\rho_1)-1\right]^2 \leq c_2-c_1 \leq \frac{1}{2}(\rho_2-\rho_1)\left[r(\rho_2)-1\right]^2.$$

Then take any $C(\cdot)$ such that $C(\rho_1) = c_1$, $C(\rho_2) = c_2$ and, for any $\rho \neq \rho_1, \rho_2$,

$$C(\rho) \geq \max\left\{c_1+\frac{1}{2}(\rho-\rho_1)\left[r(\rho_1)-1\right]^2; c_2+\frac{1}{2}(\rho-\rho_2)\left[r(\rho_2)-1\right]^2\right\}$$

Then, under any such cost function, ρ_1 and ρ_2 are both equilibrium levels and player L is better off under the low information-intensity equilibrium (i.e., the one in which ρ_1 is selected).

The result in the previous proposition stands in contrast to what arises in private-value markets with monopolistic screening. To illustrate, consider a setting in which F is a monopolistic seller choosing a take-it-or-leave-it price p to maximize expected profit $p-c(\omega)$, and player L is a buyer who decides how much information ρ to acquire about her gross valuation ω for the product, and whether to accept the offer. When the seller's production cost is constant in ω, this setup corresponds to the private-value model of Ravid, Roesler, and Szentes (2022). In that model, if information is free and the buyer can choose any mean-preserving contraction of the prior, multiple Pareto-

ranked equilibria arise, with both players' payoffs maximized in the equilibrium where the buyer becomes fully informed. By contrast, in settings with interdependent values and in which F is a representative of a competitive market, as in the Akerlof-type environment analyzed above—Proposition 3 shows that more information by the buyer can worsen the adverse selection problem. If this leads the seller to raise the price, then equilibria in which the buyer acquires more information are precisely those in which she ends up worse off, regardless of the cost of information. The result in Proposition 3 calls for government interventions aimed at discouraging information acquisition. Some of these interventions are discussed in Section 5.

4.2 Disclosure and Cognitive Style

Suppose that, given her actual choice of information ρ, L can credibly disclose hard information proving that this choice exceeds $\hat{\rho}$, with $\hat{\rho} \leq \rho$ selected by L. For instance, L may demonstrate that she commissioned a research study identifying characteristics of the asset relevant to its value, or that she underwent medical tests revealing aspects of her health that determine the value she assigns to her relationship with F.

For any $\hat{\rho} \in \mathbb{R}_+$, let the "$\hat{\rho}$-constrained game" be the no-disclosure game with modified cost function $\hat{C}(\rho; \hat{\rho}) = C(\rho)$ if $\rho \geq \hat{\rho}$ and $\hat{C}(\rho; \hat{\rho}) = +\infty$ if $\rho < \hat{\rho}$. Let $E(\hat{\rho})$ denote the set of equilibrium levels of ρ of the $\hat{\rho}$-constrained game and assume that $E(\hat{\rho})$ is non-empty for all $\hat{\rho} \in \mathbb{R}_+$. We say that the function $e(\cdot) : \mathbb{R}_+ \to \mathbb{R}_+$ is a selection if, for any $\hat{\rho} \in \mathbb{R}_+$, $e(\hat{\rho}) \in E(\hat{\rho})$.[13]

Definition 5 (**monotone selections**)**.** *The selection $e(\cdot)$ is* ***monotone*** *if for all $\hat{\rho}$ and $\hat{\rho}'$, with $\hat{\rho} < \hat{\rho}'$, $e(\hat{\rho}) \leq e(\hat{\rho}')$.*

In words, the selection is monotone if, when L is constrained to choose among levels of ρ that exceed a certain threshold, in equilibrium, as the threshold increases, L selects

[13] Shishkin (2024) analyzes an evidence acquisition game in which, when the probability of obtaining information is low, the Sender's optimal strategy follows a pass/fail structure—revealing only whether quality exceeds a threshold. The game considered here differs in two key respects: First, the acquired information is soft; second, acquisition is either overt or semi-overt, meaning that while the intensity of information acquisition can be disclosed, the information itself cannot.

a higher level. Note that, because $E(\hat{\rho}) \cap \{\rho \mid \rho \geq \hat{\rho}'\} \subseteq E(\hat{\rho}')$, it is always possible to construct monotone selections.

Definition 6 (**regularity**). *Consider any equilibrium of the primitive game with disclosure. The equilibrium is* ***regular*** *if the selection $e(\cdot)$ describing L's choice of information following any possible disclosure $\hat{\rho} \in \mathbb{R}_+$, is monotone, and if $e(0)$ coincides with an equilibrium of the no-disclosure game.*

Clearly, in any pure-strategy equilibrium of the game with disclosure, L selects a unique ρ on path. In this case, regularity imposes restrictions on the players' off-path behavior. Specifically, for any pure-strategy equilibrium in which L's equilibrium investment is ρ, let $\hat{\rho}(\rho^*)$ denote the information disclosed on path. Regularity then implies, among other things, that if L were to disclose any $\hat{\rho} < \hat{\rho}(\rho^*)$ (respectively, $\hat{\rho} > \hat{\rho}(\rho^*)$), she would, in the continuation game, choose a level of information ρ weakly below (respectively, weakly above) ρ^*.

Let $\bar{\rho}$ be the highest level of ρ supported by a pure-strategy equilibrium of the game without disclosure. It is easy to see that, without the refinement, the game with disclosure may admit pure-strategy equilibria supporting ρ^* strictly above $\bar{\rho}$. For example, suppose that information always aggravates adverse selection (i.e., $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger$, as in the case of Uniform, Pareto, or Exponential distributions—see Proposition 1). These equilibria can be sustained by a strategy for player L according to which, on path, L discloses $\hat{\rho}(\rho^*) = \rho^* > \bar{\rho}$. Off path, after disclosing any $\hat{\rho} < \rho^*$, L selects a ρ above ρ^* anticipating a low reaction by F, supported by the expectation of the choice of an experiment by L aggravating the adverse selection problem. In other words, without the refinement, there is not enough connection between the equilibrium information choices of the game with and without disclosure.

Proposition 4 (***disclosure***). *Assume that Assumptions 2 and 3 hold and that $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger$, implying that information aggravates adverse selection. Any pure-strategy equilibrium choice of information ρ of the game in which disclosure is not feasible is also an equilibrium level in the disclosure game. Conversely, the largest and smallest*

levels of ρ sustained by pure-strategy regular equilibria of the disclosure game are also equilibrium levels in the game without disclosure.

Under Assumption 3, more informative experiments worsen the adverse selection problem and elicit a less favorable response from F. As a result, L never benefits from disclosing a higher level of investment when such disclosure is interpreted as a signal of a higher actual choice. Moreover, if the marginal benefit to L from acquiring more information decreases with the friendliness of F's response—as is the case when more information reduces the probability of engagement (i.e., when, for any $(\rho^\dagger, \rho)$, $G_\rho(m^*(r(\rho^\dagger)); \rho) < 0$; see Proposition 1)—then L benefits from matching F's expectations. In this case, EC holds, as in the game without disclosure.

One can similarly consider the case of *transparency*, where L commits ex ante to reveal her exact level of information acquisition—that is, $\hat{\rho} = \rho$ for all ρ (overt acquisition). Clearly, L is better off under transparency than in the setting with voluntary disclosure considered above, and also better off than under complete opacity. More interestingly, when F's response is non-increasing in $\rho^\dagger$ (which is the case when information aggravates adverse selection, i.e., when $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger$) transparency may lead to an equilibrium in which L chooses $\rho^* \leq \underline{\rho}$, with $\underline{\rho}$ denoting the lowest equilibrium level in the no-disclosure game. Similar conclusions apply when L cannot disclose her investment precisely, but can credibly prove it is below some threshold $\hat{\rho}$ of her choosing—for example, by showing she lacks the resources to pursue more than a certain number of tests. In such cases, equilibria may exist in which L demonstrates that her investment lies below the lowest level supported in any no-disclosure equilibrium.

Another dimension of comparative statics concerns player L's cognitive style. We provide here only an informal account. Continue to assume that information exacerbates adverse selection, but now let the cost of information $C(\rho; \xi)$ depend on an ability parameter ξ, with higher ξ reflecting greater ability: for any ξ and any $\rho > 0$, $C_\rho(\rho; \xi) > 0$, $C_{\rho\rho}(\rho; \xi) > 0$ and $C_{\rho\xi}(\rho; \xi) < 0$, with $C(0; \xi) = C_\rho(0; \xi) = 0$. Under the conditions for EC in Proposition 1, equilibrium information acquisition ρ increases

with ξ in the sense of monotone comparative statics.[14] Greater ability, while directly advantageous, indirectly harms L by inducing a less friendly reaction from F, who anticipates more severe adverse selection. This suggests that, if L can signal her ability, she may want to adopt an informationally "puppy-dog" strategy (in the sense of Fudenberg and Tirole (1984)), downplaying her ability so as to temper F's response.

5 Policy Interventions

We now investigate how a benevolent government can improve over laissez-faire by subsidizing/taxing trade. For simplicity, we focus on the Akerlof model.

5.1 Optimality of Subsidizing/Taxing Trade

Let s denote the subsidy (tax if $s < 0$) the government pays to L in case of trade.[15] For any r and s, let $m^*(r, s)$ denote the engagement threshold when F's reaction is r and the subsidy is s. In the Akerlof model, $\delta_L(r, m) = r - m$, implying that $m^*(r, s) = r + s$. Let $\rho^*(s)$ and $r^*(s)$ denote, respectively, L's equilibrium investment in information and F's equilibrium response in the game with subsidy s. Throughout, we assume that $\rho^*(s)$ and $r^*(s)$ are unique, and that $\rho^*(\cdot)$ and $r^*(\cdot)$ are Lipschitz continuous, and differentiable.[16] For any s, total welfare—up to multiplicative and additive constants irrelevant for the analysis—is given by

$$W(s) \equiv \int_{-\infty}^{m^*(r^*(s),s)} (\delta_L(r^*(s), m) + s)\, dG(m; \rho^*(s)) - C(\rho^*(s)) \\ -(1+\lambda)sG(m^*(r^*(s), s); \rho^*(s)),$$

where $\lambda \geq 0$ denotes the unit cost of public funds (capturing the deadweight loss from distorting taxation). The first two terms reflect L's expected payoff, while the final

[14] The lowest and highest elements of the equilibrium correspondence rise with ξ.

[15] More generally, both the decision to engage and not engage can be subject to subsidies/taxes. For example, the decision to hold on an asset can be taxed. Hence, in the analysis below, s should be interpreted as the differential in the subsidy/tax when L engages.

[16] In addition to facilitating the description of the relevant optimality conditions, these properties validate a certain envelope theorem that we use in the Appendix to establish some of the results.

term represents the cost of the program to the government. We assume throughout that W is strictly quasi-concave.

Proposition 5 (***social value of subsidizing/taxing trade***)**.** *Suppose that Assumption 3 holds. A strictly positive subsidy is optimal when*

$$\frac{\partial}{\partial m^*} M^-(r^*(0);\rho^*(0)) + \frac{\partial}{\partial \rho} M^-(r^*(0);\rho^*(0)) \frac{d\rho^*(0)}{ds} > \lambda,$$

whereas a tax on trade is optimal when the above inequality is reversed.[17]

Whether subsidizing trade is preferable to taxing it depends on whether, holding F's reaction fixed at the laissez-faire level $r^*(0)$, the effect of a subsidy (or tax) on mitigating adverse selection outweighs the cost of the intervention. When information is endogenous, subsidies affect adverse selection through two channels. First, a higher subsidy raises the threshold $m^*(r,s) = r + s$. Since M^- increases in m^*, this effect always helps mitigate adverse selection. Second, a subsidy may also affect player L's choice of information. The direction of this second effect depends on whether information alleviates or exacerbates adverse selection, and on whether the subsidy increases or decreases ρ. From Proposition 1, we know that, under Assumption 1, information aggravates adverse selection when it reduces the probability of trade; that is, when $G_\rho(r^*(0);\rho^*(0)) < 0$. Under this condition, a small subsidy reduces L's investment in information provided that the equilibrium exhibits the same monotonicity properties as the players' best responses.[18]

[17] As we show in the Appendix, for more general payoff functions δ_L, the result is the following: there exists $K > 0$ such that a strictly positive (respectively, negative) s is optimal if $\frac{d}{ds} M^-(m^*(r^*(0),s);\rho^*(s))\big|_{s=0}$ is strictly greater (respectively, smaller) than K. See the Supplement for how the conclusion flips in the anti-lemons case.

[18] Note that, holding ρ fixed at $\rho^*(0)$, an increase in s, starting from $s = 0$, always increases r. Likewise, holding r fixed at $r^*(0)$, an increase in s, starting from $s = 0$, always reduces ρ when $G_\rho(r^*(0);\rho^*(0)) < 0$.

5.2 Subsidy's Double Dividend

Let s^* be the optimal policy when information is endogenous, and $\rho^*(s^*)$ and $r^*(s^*)$ the corresponding equilibrium levels. Suppose now that information is exogenously fixed at $\rho = \rho^*(s^*)$. For any policy s, define $W^{\#}(s)$ as equilibrium welfare under this fixed information level. Assume $W^{\#}(s)$ is strictly quasi-concave, and let s^{**} denote the value that maximizes it.

Proposition 6 (***subsidy's double dividend***)**.** *Suppose that Assumption 1 holds, $G(\cdot;\rho)/g(\cdot;\rho)$ is increasing in m when $\rho = \rho^*(s^*)$, and $G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) < 0$. Then, when information is exogenous and equal to $\rho^*(s^*)$, the optimal subsidy satisfies $s^{**} < s^*$.*

That G/g is increasing in m ensures that Assumption 3 (lemons) holds. That information structures are consistent with the MPS order and $G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) < 0$ in turn implies that information aggravates adverse selection and a reduction in r raises L's value of information (see Proposition 1). Starting from s^*, a marginal reduction in s thus has a more pronounced effect under endogenous information than under exogenous information. Specifically, with endogenous information, F anticipates lower engagement by L and reduces the price accordingly, which in turn prompts L to acquire more information—further aggravating the adverse selection problem and reinforcing the price drop. Hence, the optimal subsidy is strictly higher under endogenous information. A similar logic applies to Example (a) in the Supplement, where the government designs asset purchase programs and directly controls the trading price. There too, the presence of endogenous information strengthens the case for more aggressive policy intervention.

The results above highlight a general insight: when increasing trade is socially beneficial, information aggravates adverse selection, and a friendlier reaction by F reduces the marginal benefit of information for L, the social value of subsidizing trade is greater under endogenous information. This is because a subsidy yields a double

dividend: it not only encourages greater engagement, but also discourages information acquisition. The latter effect alleviates adverse selection, thereby inducing more trade and further amplifying the welfare gains from the intervention.

6 Flexible Information

The results so far rely on Assumption 1, which requires that player L's experiments be consistent with the MPS order. In this section, we relax this assumption. First, we provide an analog of Proposition 1 by introducing an alternative order over L's investment that does not require that the experiments themselves being ordered. We then show that, when the cost is as in the rational inattention literature, in the Akerlof model, fully efficient equilibria can coexist with equilibria in which L engages selectively, but also with market breakdown equilibria where trade does not occur despite L not acquiring any information and both players recognizing that there are positive gains from trade.

6.1 Entropy and Max-slope Cost Functionals

Consider an arbitrary experiment $q : \Omega \to \Delta(Z)$, mapping states into distributions over a rich (Polish) signal space Z. Combined with the prior G over Ω, any such experiment induces a distribution over the posterior mean m. In conjunction with the optimal engagement strategy—determined by the anticipation of F's reaction, r—q also induces a stochastic choice rule $\sigma^q : \Omega \to [0, 1]$, specifying the probability that L engages in each state ω. Accordingly, one can think of L as directly choosing a rule σ subject to a cost functional $\mathcal{C}(\sigma)$, interpreted as the minimal cost of an experiment capable of implementing σ. Two cost functionals that have received particular attention in the literature are those based on entropy and maximal slope.

Entropy. For any experiment q, let the *mutual information* between the state ω

and the signal realization z be defined as:

$$I^q = \int_\omega \int_z \ln(q(z|\omega))q(\mathrm{d}z|\omega)dG(\omega) - \int_z \ln\left(\int_\omega q(z|\omega)dG(\omega)\right)\int_\omega q(z|\omega)dG(\omega)$$

where the distribution of the random variable z is obtained by combining the prior G with the experiment q. The cost of the experiment is $I^q/\rho + C(\rho)$, where $\rho \in \mathbb{R}_+$. The interpretation is that, to process information at rate ρ, player L must undertake an investment (e.g., through training) at cost $C(\rho)$, with C satisfying the same assumptions as in Section 2. Allowing L to choose ρ in addition to q is useful because a higher ρ provides an unambiguous measure of a greater investment in information processing. This, in turn, facilitates comparison with the analysis in the previous sections, where the experiments themselves were assumed to be ordered.

Max-slope. Alternatively, suppose that the cost of inducing a stochastic choice rule σ is given by $\mathcal{C}(\sigma) = c\left(\sup\left\{|\sigma'(\omega)|\right\}\right)$, where $c : \mathbb{R}_+ \cup \{+\infty\} \to \mathbb{R}_+ \cup \{+\infty\}$ is a non-decreasing function satisfying $c(0) = 0$ and $c(k) < \infty$ for all $k \in \mathbb{R}_+$. Here, $\sigma'(\omega)$ denotes the derivative of σ at ω. At any point of discontinuity, $\sigma'(\omega) = +\infty$. At points where σ is continuous but non-differentiable, $\sigma'(\omega)$ is the maximum of the left and right derivatives.[19] To facilitate comparison with the previous sections, assume again that ρ denotes the maximal slope of the stochastic choice rule implemented by L, chosen at cost $C(\rho)$, with C satisfying the same assumptions as in Section 2. Given ρ, L selects the experiment that maximizes her expected payoff among those inducing a stochastic choice rule with maximal slope no greater than ρ.

6.2 Expectation Conformity

For any pair (ρ, r), let $q^{\rho,r}$ denote L's optimal experiment when investing ρ and anticipating reaction r. Under both the entropy-based and max-slope cost functionals, $q^{\rho,r}$ is binary, with $z = 1$ interpreted as a recommendation to engage and $z = 0$ as a rec-

[19] Cost functionals of this type have been considered for example in Robson (2001), Rayo and Becker (2007), Netzer (2009), and, more recently, Morris and Yang (2022).

ommendation not to engage. Given any investment level ρ, reaction r, and cutoff m^*, define $M^-(m^*;\rho,r)$ as the expected posterior mean conditional on $m \leq m^*$, under the experiment $q^{\rho,r}$. Observe that, when the cutoff equals the optimal one, $m^*(r)$ (as characterized in the previous sections), we have that $M^-(m^*(r);\rho,r) = \mathbb{E}[\omega|z=1;q^{\rho,r}]$. Moreover, the derivative of M^- with respect to ρ satisfies $\partial M^-(m^*(r);\,\rho,r)/\partial\rho \overset{\text{sgn}}{=} A(m^*(r);\rho,r)$, where

$$A(m^*(r);\rho,r) \equiv \big[m^*(r) - M^-(m^*(r);\,\rho,r)\big]G_\rho(m^*(r);\rho,r) - \int_{-\infty}^{m^*(r)} G_\rho(m;\rho,r)dm.$$

Here, $G(m;\rho,r)$ is the cumulative distribution function of the posterior mean under $q^{\rho,r}$, and $G_\rho(m;\rho,r)$ denotes its partial derivative with respect to ρ. This derivative captures how the distribution of posterior means shifts as ρ changes, via the induced change in the optimal experiment. As in Section 3, the sign of A determines whether an increase in ρ aggravates or alleviates the adverse selection problem.

Let $r(\rho)$ denote F's equilibrium reaction in a fictitious game where L's investment level is exogenously fixed at ρ. Differently from Section 3, once ρ is given, L can still choose an experiment $q:\Omega\to\Delta(Z)$, which in turn induces a distribution over her posterior mean. The equilibrium reaction $r(\rho)$ is therefore determined jointly with the equilibrium experiment q and the associated engagement strategy $a(\cdot)$. Let $\Pi(\rho;r) \equiv U_L(0) + \int_{-\infty}^{+\infty}\delta_L(r,\omega)q^{\rho,r}(1|\omega)dG(\omega)$ denote L's payoff, gross of any information cost, when choosing the optimal experiment $q^{\rho,r}$ and

$$\begin{aligned} B(\rho;\rho^\dagger) \;\equiv\; & -\frac{\partial^2\Pi(\rho;r(\rho^\dagger))}{\partial\rho\partial r} = -\frac{\partial\delta_L(r(\rho^\dagger),m^*(r(\rho^\dagger)))}{\partial r}G_\rho\Big(m^*(r(\rho^\dagger));\rho,r(\rho^\dagger)\Big) \\ & + \int_{-\infty}^{m^*(r(\rho^\dagger))}\frac{\partial^2\delta_L(r(\rho^\dagger),m)}{\partial r\partial m}G_\rho(m;\rho,r(\rho^\dagger))dm \end{aligned}$$

the marginal benefit of increasing ρ in response to a marginal reduction in r starting from $r(\rho^\dagger)$. The key distinction from Section 3 is that $B(\rho;\rho^\dagger)$ now accounts for the fact that L optimally selects an experiment after choosing ρ, rather than working with a specific experiment indexed by ρ as in the previous sections.

As in Section 3, interpret $\mathrm{A}(\rho^\dagger) \equiv A(m^*(r(\rho^\dagger)); \rho^\dagger, r(\rho^\dagger))$ as capturing the "adverse selection effect" and $B(\rho; \rho^\dagger)$ the "benefit of friendlier reactions" effect.

Proposition 7 (***EC under flexible information***)**.** *Suppose that Assumptions 2 and 3 hold and that ρ determines either the marginal cost of entropy reduction or the maximum slope of the induced stochastic choice rule.*
(i) EC holds at $(\rho, \rho^\dagger)$ if and only if $\mathrm{A}(\rho^\dagger)\mathrm{B}(\rho; \rho^\dagger) < 0$.
(ii) A sufficient condition for an increase in ρ to aggravate adverse selection at $\rho = \rho^\dagger$ (i.e., for $\mathrm{A}(\rho^\dagger) < 0$) is that, $q^{\rho, r(\rho^\dagger)}(1|\omega)/q^{\rho, r(\rho^\dagger)}(1)$ is increasing in ρ for $\omega < m^*(r(\rho^\dagger))$ and decreasing in ρ for $\omega > m^*(r(\rho^\dagger))$ at $\rho = \rho^\dagger$.
(iii) A sufficient condition for a reduction in the friendliness of F's reaction at $r(\rho^\dagger)$ to raise L's marginal value of ρ (i.e., for $B(\rho; \rho^\dagger) > 0$) is that, in addition to $q^{\rho, r(\rho^\dagger)}$ satisfying the condition in part (ii), the total probability $q^{\rho, r(\rho^\dagger)}(1) \equiv \int q^{\rho, r(\rho^\dagger)}(1|\omega) dG(\omega)$ player L engages is non-increasing in ρ.
(iv) Suppose that $M^-(m^*(r(\rho^\dagger)); \rho, r(\rho^\dagger))$ is decreasing in ρ at $\rho = \rho^\dagger$, implying that $\mathrm{A}(\rho^\dagger) < 0$, and that $\partial^2 \delta_L(r, m)/\partial r \partial m = 0$. Then $q^{\rho, r(\rho^\dagger)}(1)$ non-increasing in ρ at $\rho = \rho^\dagger$ is necessary and sufficient for EC at $(\rho, \rho^\dagger)$.

As in Section 3, EC obtains when, and only when, the adverse-selection effect is of opposite sign than the benefit of friendlier reactions effect, i.e., when $\mathrm{A}(\rho^\dagger)B(\rho; \rho^\dagger) < 0$. The intuition is the same as when information is rigid and the experiments are consistent with the MPS order.

When information is flexible, an increase in ρ (starting from $\rho^\dagger$) aggravates the adverse selection problem when it induces L to select an experiment that makes her engage with a higher probability at low states (namely for $\omega < m^*(r(\rho^\dagger))$) and with a lower probability at high states (namely for $\omega > m^*(r(\rho^\dagger))$), relative to the total probability $q^{\rho, r(\rho^\dagger)}(1)$ of engaging. This is because, in the eyes of player F, such changes make the engagement decision more informative of the state being less favorable to F. When, in addition to the last property described, a higher ρ also reduces the overall probability $q^{\rho, r(\rho^\dagger)}(1)$ that player L engages, starting from the actual level ρ selected

by L, a reduction in r starting from $r(\rho^\dagger)$ increases L's marginal value of expanding ρ.

The property that $q^{\rho,r(\rho^\dagger)}(1)$ decreases with ρ is equivalent to the property that a higher ρ reduces the probability of trade under the MPS order (i.e., $G_\rho(m^*\big(r(\rho^\dagger)\big);\rho)) < 0$). This condition is both necessary and sufficient for EC when L's payoff is separable in r and ω (as in the Akerlof model) and a higher ρ always aggravates the adverse selection problem in the eyes of player F.

The results above are the analogs of those established in Proposition 1 for the case where ρ is a mean-preserving-spread index, thus establishing the robustness of the key insights to the flexible information structures considered in this section.

6.3 Akerlof with Entropy Cost

We now specialize the analysis to the Akerlof model and assume that the cost of any signal q is proportional to its entropy reduction. For simplicity, we assume here that ρ is exogenous. As explained above, allowing for an endogenous ρ served primarily to establish EC in the absence of an order over the experiments themselves. In the Supplement, we expand the analysis in this subsection by endogenizing ρ.

Let $[\underline{\omega}, \bar{\omega}]$ denote the support of the prior distribution G. Given any price r and any binary signal q (with $q(1|\omega)$ denoting the probability of trading when the state is ω), L's payoff is

$$\int (r-\omega)q(1|\omega)dG(\omega) + \omega_0 - \frac{I^q}{\rho}, \tag{8}$$

where $I^q = \int \phi(q(1|\omega))dG(\omega) - \phi(q(1))$ is the entropy reduction brought by the experiment, with $q(1) \equiv \int q(1|\omega)dG(\omega)$, and where ϕ is the function defined by $\phi(0) = \phi(1) \equiv 0$ and, for any $q \in (0,1)$, by $\phi(q) \equiv q\ln(q) + (1-q)\ln(1-q)$.

Let $\underline{r}(\rho)$ and $\overline{r}(\rho)$ be implicitly defined by, respectively, the following two equations

$$\int e^{-\rho\omega}dG(\omega) = e^{-\rho\underline{r}} \quad \text{and} \quad \int e^{\rho\omega}dG(\omega) = e^{\rho\overline{r}}$$

and note that $\omega_0 \in (\underline{r}(\rho), \overline{r}(\rho))$. Next, for any $r \in (\underline{r}(\rho), \overline{r}(\rho))$, let $\tilde{\omega}(r;\rho)$ be implicitly defined by

$$\tilde{\omega} = r + \frac{1}{\rho} \ln \left(\frac{\int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)}{1 - \int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)} \right). \tag{9}$$

Following Woodford (2008) and Yang (2015), one can show that, for any r, the seller's optimal signal is such that, for all ω,

$$q^{\rho,r}(1|\omega) = \begin{cases} 0 & \text{if } r \leq \underline{r}(\rho) \\ \frac{1}{1+e^{\rho(\omega-\tilde{\omega}(r;\rho))}} & \text{if } r \in (\underline{r}(\rho), \overline{r}(\rho)) \\ 1 & \text{if } r \geq \bar{r}(\rho). \end{cases} \tag{10}$$

Intuitively, when $r \leq \underline{r}(\rho)$ (respectively, $r \geq \bar{r}(\rho)$), L expects the realized value of ω to be greater (respectively, smaller) than r with very high probability. She then finds it optimal not to acquire any information and refrain from selling (respectively, sell) with probability one. It is only for intermediate values of r, namely for $r \in (\underline{r}(\rho), \overline{r}(\rho))$, that L acquires information. When this is the case, the optimal signal is a logistic function indexed by the position parameter $\tilde{\omega}(r;\rho)$.

Any equilibrium in which L trades selectively as a function of ω is then indexed by a pair $(\tilde{\omega}, r)$ that jointly solves the following conditions

$$\begin{cases} \tilde{\omega} = r + \frac{1}{\rho} \ln \left(\frac{\int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)}{1 - \int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)} \right), \\ r = \int \omega \frac{\frac{1}{1+e^{\rho(\omega-\tilde{\omega})}}}{\int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)} dG(\omega) + \Delta, \\ r \in (\underline{r}(\rho), \overline{r}(\rho)). \end{cases} \tag{11}$$

The first equation represents how L's optimal signal depends on the (anticipated) price r offered by F. The second equation is F's break-even condition, when expecting L to choose the logistic binary signal q indexed by the position parameter $\tilde{\omega}$ and engage if and only if $z = 1$. The last condition is a (necessary and sufficient) condition guaranteeing that L prefers to acquire some information to either holding the good or

selling it without learning the state.

The game may also admit equilibria in which L does not acquire any information and then either never engages or always engages. Consider first equilibria in which trade does not occur. In any of these equilibria, L acquires no information. Whether such a behavior can be sustained in equilibrium depends on how F responds in case L deviates and puts the asset on sale. Suppose that F responds with a price $r \leq \underline{r}(\rho)$. When L anticipates such a low price, it is indeed optimal for her not to acquire any information and refrain from putting the asset on sale. Provided that $\underline{\omega} + \Delta < \underline{r}(\rho)$, such a low price can be consistent with F's rationality. In fact, if F interprets L's deviation as reflecting the acquisition of a signal whose realization reveals that the state is low (say close to $\underline{\omega}$) with a high probability, then it is optimal for F to offer a price $r \leq \underline{r}(\rho)$. Note that, because the signal that recommends to L to put the asset on sale only when the asset's value is the lowest (here $\omega = \underline{\omega}$) is costless, such equilibria survive most forward-induction refinements such as D1. We then have the following result:

Proposition 8 (***new form of market breakdown***)**.** *Fix G and Δ and assume that $\underline{\omega} + \Delta < \omega_0$. There exists $\underline{\rho}(G, \Delta) > 0$ such that an equilibrium in which the seller does not acquire any information and does not put the asset on sale exists if and only if $\rho \leq \underline{\rho}(G, \Delta)$.*

As anticipated in the Introduction, Proposition 8 identifies a novel form of market breakdown whereby the seller does not put the asset on sale despite the buyer knowing that the seller does not possess any private information and that his value for the asset is higher than the seller's. These equilibria are sustained by the fact that, if the seller were to deviate and put the asset on sale, the representative buyer would respond with a very low price, sustained by the belief that the seller deviated and acquired information revealing that the asset's value is low.

The reason why the existence of such equilibria under fully flexible information is interesting is the following. When the cost is linked to entropy reduction, the marginal

cost is zero when the seller acquires a signal that recommends to sell (with strictly positive probability) only for very low states (close to $\underline{\omega}$). The benefit of these signals, however, is also very limited, with the benefit vanishing faster than the cost as $q(1|\omega)$ converges to zero for such low states.

Such equilibria cease to exist under an alternative timing whereby the buyer offers a price after the seller acquired information but before the seller decides to engage (i.e., to put the asset on sale). In this case, if the buyer anticipates that the seller did not acquire any information, she necessarily offers $r = \omega_0 + \Delta$, which the seller accepts in the absence of any information. However, whether such equilibria exist depends on whether, anticipating a price $r = \omega_0 + \Delta$, it is indeed optimal for the seller not to acquire any information in the first place, which we address next.[20]

As explained above, in any equilibrium in which the seller does not acquire any information and trades with certainty, the price offered by the buyer is $r = \omega_0 + \Delta$. The seller finds it optimal not to acquire any information and put the asset on sale with certainty if and only if $r \geq \overline{r}(\rho)$. The following is then true:

Proposition 9 (***efficient equilibrium***)**.** *Fix G and Δ, and assume that $\omega_0 + \Delta < \overline{\omega}$. There exists $\bar{\rho}(G, \Delta) > 0$ such that an efficient equilibrium in which the seller does not acquire any information, puts the asset on sale with probability one, and trades with certainty exists if and only if $\rho \leq \bar{\rho}(G, \Delta)$.*

Together, the last two propositions imply the following:

[20]Note that equilibria in which the market breaks down without the seller acquiring any information also exist in a different variant of the model in which the seller's choice of an experiment *follows the observation of the price offered by the buyer*. These equilibria exist if, for any $r \in [\underline{r}(\rho), \bar{r}(\rho)]$,

$$r > \int \omega \frac{\frac{1}{1+e^{\rho(\omega-\tilde{\omega})}}}{\int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)} dG(\omega) + \Delta,$$

with $\tilde{\omega} = r + \frac{1}{\rho} \ln \left(\frac{\int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)}{1 - \int \frac{1}{1+e^{\rho(\omega-\tilde{\omega})}} dG(\omega)} \right)$, and $\bar{r}(\rho) > \omega_0 + \Delta$. In this case, all equilibria feature no trade and are sustained by the buyer offering a price $r(\rho) < \underline{r}(\rho)$, with the understanding that any deviation to any price $r < \underline{r}(\rho)$ induces no trade, any deviation to a price $r \in [\underline{r}(\rho), \bar{r}(\rho)]$ induces the seller to acquire a logistic signal under which the buyer incurs a loss when the signal recommends to the seller to accept the buyer's price, and any deviation to a price $r > \bar{r}(\rho)$ induces the seller to sell with certainty but again results in a loss for the buyer.

Corollary 2 (***multiple corner equilibria***). *Fix G and Δ and assume that $\underline{\omega} + \Delta < \omega_0 < \overline{\omega} - \Delta$. For any $\rho \leq \min\{\underline{\rho}(G, \Delta), \bar{\rho}(G, \Delta)\}$, an efficient equilibrium in which the seller does not acquire any information and trades with certainty coexists with one in which the market breaks down despite the fact that it is common knowledge between the buyer and the seller that there is no asymmetric information and there are strictly positive gains from trade.*[21]

Provided the cost of public funds is small enough, the market failure documented in Corollary 2 can be corrected by subsiding trade, along the lines of what discussed in Section 5. In fact, for any ρ and any subsidy s, an equilibrium with no trade exists if and only if $\underline{\omega} + \Delta < \underline{r}(\rho) - s$. Equivalently, for any s, there exists a threshold $\rho^{\#}(G, \Delta, s) < \underline{\rho}(G, \Delta)$ such that, when $\rho \in (\rho^{\#}(G, \Delta, s), \underline{\rho}(G, \Delta)]$, the market may break down in the laissez-faire economy but not when trade is subsidized.

Turning to equilibria with partial information acquisition, we note that these equilibria do not exist for low levels of ρ whereas, for large ρ, they are given by the solution to the system in (11). These equilibria cannot be solved in closed form. However, simulations suggest that, when they do exist, such equilibria are unique and are such that $r(\rho)$ is decreasing in ρ, with $r(\rho)$ converging to the equilibrium level in Akerlof (1970) as ρ grows large. This is because the logistic signal optimally acquired by the seller when the cost of entropy reduction is lower (equivalently, ρ is higher) induces the seller to trade more selectively as a function of the state (in the sense of part (ii) of Proposition 7) aggravating adverse selection and inducing the buyer to respond with a lower price.

7 Conclusions

We investigate properties of generalized lemons (and, in the Supplement, anti-lemons) problems in which the information possessed by the engaging player is endogenous.

[21] If $\omega_0 > \overline{\omega} - \Delta$ the efficient equilibrium exists for any ρ. If, instead, $\omega_0 < \underline{\omega} + \Delta$, the market breakdown equilibrium does not exist, for any ρ.

We show how expectation conformity, i.e., the value to conform to the expectations held by other players, is affected by (a) the impact of information on the severity of the adverse selection problem, (b) the sensitivity of the marginal value of information to the friendliness of other players' reactions, and (c) the gains from trade. We use the characterization to shed light on the connection between expectation conformity and the multiplicity of equilibria, the possibility of expectation traps, and the role of disclosure of hard information in such games. We then investigate how a benevolent government can improve upon the laissez-faire equilibrium by subsidizing (alternatively, taxing) trade and identify conditions under which the endogeneity of information calls for more generous programs. Finally, we show how the results can accommodate for fully flexible information acquisition.

There are many venues for future research. In more applied work geared at understanding the role of endogenous information in financial trading, it would be interesting to study how public disclosures impact the incentives for private information acquisition. In the context of stress testing, the announcement that a bank failed a test may induce a conservative response by potential asset buyers which may induce asset owners to collect more information, which in turn aggravates the severity of the adverse selection problem. It would also be interesting to extend the analysis by allowing both sides of the market to acquire information and investigate how strategic complementarity/substitutability in information acquisition is affected by the adverse selection problem.

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8 Appendix

Proof of Proposition 1. (i) By the chain rule and the definitions of the V_L and B functions, we have that $\partial^2 V_L(\rho;\rho^\dagger)/\partial\rho\partial\rho^\dagger = -B(\rho;\rho^\dagger)dr(\rho^\dagger)/d\rho^\dagger$. Assumption 3, together with Conditions (3), (4), and (5) imply that $dr(\rho^\dagger)/d\rho^\dagger$ is of the same sign as $\mathrm{A}(\rho^\dagger)$. EC thus holds at $(\rho,\rho^\dagger)$ if, and only if, $\mathrm{A}(\rho^\dagger)$ and $B(\rho;\rho^\dagger)$ are of opposite sign.
(ii) Using Condition (3), we have that, for any $m^*\in\mathbb{R}$ and $\rho^\dagger$, the sign of $\partial M^-(m^*;\rho^\dagger)/\partial\rho^\dagger$ is given by the sign of $A(m^*;\rho^\dagger)$, with $A(m^*;\rho^\dagger)$ as defined in (4). Because a higher ρ indexes a mean-preserving spread, the second term of (4) is always negative. Hence, starting from $\rho^\dagger$, information aggravates adverse selection (that is, $\mathrm{A}(\rho^\dagger)<0$) when the first term of (4) is also negative, which is the case when $G_\rho(m^*(r(\rho^\dagger));\rho^\dagger)<0$.

Note, however, that this condition is sufficient but not necessary for $\mathrm{A}(\rho^\dagger) < 0$, as the following examples illustrate:

- *Uniform distribution*: m is drawn uniformly from $[\underline{m}(\rho), \bar{m}(\rho)]$, with $\underline{m}(\rho)$ decreasing in ρ and satisfying $\underline{m}(\rho) \leq \omega_0$ for all ρ, and $\bar{m}(\rho) = 2\omega_0 - \underline{m}(\rho)$ for all ρ (mean preservation). Then for any $m^* \in [\underline{m}(\rho), \bar{m}(\rho)]$, $G(m^*; \rho) = (m^* - \underline{m}(\rho)) / [2(\omega_0 - \underline{m}(\rho))]$. This family of distributions is thus consistent with the rotation order of Definition 1, with rotation point $m_\rho = \omega_0$ for all ρ: $G_\rho(m^*; \rho) < 0$ if $m^* > \omega_0$, whereas $G_\rho(m^*; \rho) > 0$ if $m^* < \omega_0$. For any $m^* \in [\underline{m}(\rho), \bar{m}(\rho)]$, $M^-(m^*; \rho) = \frac{1}{2}(m^* + \underline{m}(\rho))$ which is decreasing in ρ. Hence, when $m^*(r(\rho^\dagger)) \in [\underline{m}(\rho^\dagger), \bar{m}(\rho^\dagger)]$, $\mathrm{A}(\rho^\dagger) < 0$, irrespective of the sign of $G_\rho(m^*(r(\rho^\dagger)); \rho^\dagger)$.

- *Pareto distribution*: m is drawn from $[\underline{m}(\rho), +\infty)$ according to the cdf $G(m; \rho) = 1 - (\underline{m}(\rho)/m)^{\alpha(\rho)}$, with $\underline{m}(\rho)$ decreasing in ρ and $\alpha(\rho) = \omega_0/(\omega_0 - \underline{m}(\rho))$ for all ρ.[22] This family of distributions too is consistent with the rotation order of Definition 1. For each ρ, the rotation point is $m_\rho = \underline{m}(\rho) \exp((\omega_0 - \underline{m}(\rho)) / \underline{m}(\rho))$. Furthermore, for any $m^* > \underline{m}(\rho)$,

$$M^-(m^*; \rho) = \omega_0 \frac{1 - \left(\frac{\underline{m}(\rho)}{m^*}\right)^{\alpha(\rho)-1}}{1 - \left(\frac{\underline{m}(\rho)}{m^*}\right)^{\alpha(\rho)}}$$

  which is decreasing in ρ. Hence, when $m^*(r(\rho^\dagger)) > \underline{m}(\rho^\dagger)$, $\mathrm{A}(\rho^\dagger) < 0$, irrespective of the sign of $G_\rho(m^*(r(\rho^\dagger)); \rho^\dagger)$.

- *Exponential distribution*: m is drawn from $[\underline{m}(\rho), +\infty)$ according to the cdf $G(m; \rho) = 1 - e^{-\lambda(\rho)(m - \underline{m}(\rho))}$, with $\underline{m}(\rho)$ decreasing in ρ and $\lambda(\rho) = 1/(\omega_0 - \underline{m}(\rho))$ for all ρ.[23] One can verify that an increase in ρ induces a rotation of $G(m; \rho)$ in the sense of Definition 1, with rotation point $m_\rho = \omega_0$ for all ρ. Furthermore, for

[22] Note that the function $\alpha(\rho)$ is constructed so that, for any ρ, given $\underline{m}(\rho)$, $\mathbb{E}_{G(\cdot;\rho)}[m; \rho] = \frac{\alpha(\rho)\underline{m}(\rho)}{\alpha(\rho)-1} = \omega_0$ (mean preservation).

[23] Again, the function $\lambda(\rho)$ is constructed so that, for any ρ, given $\underline{m}(\rho)$, $\mathbb{E}_{G(\cdot;\rho)}[m; \rho] = \underline{m}(\rho) + \frac{1}{\lambda(\rho)} = \omega_0$ (mean preservation).

any $m^* > \underline{m}(\rho)$

$$M^-(m^*;\rho) = \omega_0 - \frac{(m^* - \underline{m}(\rho))\, e^{-\lambda(\rho)(m^* - \underline{m}(\rho))}}{1 - e^{-\lambda(\rho)(m^* - \underline{m}(\rho))}}$$

which is decreasing in ρ. Hence, when $m^*(r(\rho^\dagger)) > \underline{m}(\rho^\dagger)$, $\mathrm{A}(\rho^\dagger) < 0$, irrespective of the sign of $G_\rho(m^*(r(\rho^\dagger));\rho^\dagger)$.

(iii) Recall that, starting from $r = r(\rho^\dagger)$, a reduction in the friendliness of F's reaction raises the incentive to acquire information at ρ if and only if $B(\rho;\rho^\dagger) > 0$, with $B(\rho;\rho^\dagger)$ satisfying Condition (6). The second term in (6) is positive because, by Assumption 1, ρ is a mean-preserving-spread index and $\partial^2\delta_L/\partial r\partial m$ is positive (by Assumption 2) and constant in m (by the assumption that δ_L is affine in m). Because δ_L is increasing in r by Assumption 2, the first term in (6) is also positive if $G_\rho(m^*\big(r(\rho^\dagger)\big);\rho) < 0$. Now use the results in the proof of part (ii) above to verify that, in the Uniform, Pareto, and Exponential case, this condition holds when $m^*\big(r(\rho^\dagger)\big) > m_\rho$.

(iv) The result follows from parts (i)-(iii) in the proposition, along with the fact that, in this case, the second term in (6) is zero. Because δ_L is increasing in r, we thus have that $B(\rho;\rho^\dagger) \overset{\text{sgn}}{=} -G_\rho(m^*\big(r(\rho^\dagger)\big);\rho)$. Hence, $B(\rho;\rho^\dagger) > 0$ if and only if $G_\rho\Big(m^*\big(r(\rho^\dagger)\big);\rho\Big) < 0$. ■

Proof of Proposition 2. Observe that, under Assumption 2, given r, the engagement threshold $m^*(r;\theta)$, which is implicitly defined by the solution to $\bar{\delta}_L(r,m) + \theta = 0$, is increasing in θ. Also observe that, under Assumption 3, given $\rho^\dagger$, $r(\rho^\dagger;\theta)$ is increasing in θ; this is because, fixing r and $\rho^\dagger$, a higher θ implies a higher engagement point $m^*(r;\theta)$, and hence a higher truncated mean $M^-(m^*(r;\theta);\rho^\dagger)$ which in turn implies a higher equilibrium response $r(\rho^\dagger;\theta)$ by virtue of Assumption 3. Because, for any θ, $m^*(r;\theta)$ is also increasing in r, we conclude that, for any $\rho^\dagger$ and any $\theta'' > \theta'$, $m^*(r(\rho^\dagger;\theta'');\theta'') \geq m^*(r(\rho^\dagger;\theta');\theta')$. Now take any $(\rho,\rho^\dagger,\theta')$ such that $G_\rho(m^*(r(\rho^\dagger;\theta'),\theta');\rho^\dagger), G_\rho(m^*(r(\rho^\dagger;\theta'),\theta');\rho) < 0$. Proposition 1 implies that, when $\theta = \theta'$, EC holds at $(\rho,\rho^\dagger)$. That information structures are rotations in turn implies that $\max\{m_\rho, m_{\rho^\dagger}\} \leq m^*(r(\rho^\dagger;\theta'),\theta')$, which along with $m^*(r(\rho^\dagger;\theta'');\theta'') \geq$

$m^*(r(\rho^\dagger;\theta');\theta')$, implies that $\max\{m_\rho, m_{\rho^\dagger}\} \leq m^*(r(\rho^\dagger;\theta''),\theta'')$ and hence that

$$G_\rho(m^*(r(\rho^\dagger;\theta''),\theta'');\rho^\dagger), G_\rho(m^*(r(\rho^\dagger;\theta''),\theta'');\rho) < 0.$$

When EC holds at (ρ,$\rho^\dagger$) for $\theta = \theta'$, it thus also holds for $\theta = \theta''$. ■

Proof of Proposition 3. Using the result in Proposition 1, we have that, under the conditions in the proposition, EC holds for any $\rho, \rho^\dagger \in [\rho_1, \rho_2]$, implying that

$$V_L\big(\rho_2;\rho_2\big) - V_L\big(\rho_1;\rho_2\big) \geq V_L\big(\rho_2;\rho_1\big) - V_L\big(\rho_1;\rho_1\big) > 0.$$

Then pick any $c_1, c_2 \in \mathbb{R}_{++}$ such that $c_1 \leq V_L\big(\rho_1;\rho_1\big)$, $c_2 \leq V_L\big(\rho_2;\rho_2\big)$ and

$$V_L\big(\rho_2;\rho_1\big) - V_L\big(\rho_1;\rho_1\big) \leq c_2 - c_1 \leq V_L\big(\rho_2;\rho_2\big) - V_L\big(\rho_1;\rho_2\big).$$

Then take any C such that $C(\rho_1) = c_1$, $C(\rho_2) = c_2$ and, for any $\rho \neq \rho_1, \rho_2$,

$$C(\rho) \geq \max\left\{c_1 + V_L\big(\rho;\rho_1\big) - V_L\big(\rho_1;\rho_1\big); c_2 + V_L\big(\rho;\rho_2\big) - V_L\big(\rho;\rho_2\big)\right\}.$$

Then, under any such cost function, ρ_1 and ρ_2 are both equilibrium levels and player L is better off under the low information-intensity equilibrium (i.e., the one in which ρ_1 is selected). Furthermore, one can take C to be non-decreasing and continuous.

Next, observe that, for any given r, L's net payoff is equal to

$$\mathcal{V}(r) = \sup_\rho\{U_L(0) + \int_{-\infty}^{m^*(r)} \delta_L(r,m)dG(m;\rho) - C(\rho)\}.$$

The envelope theorem, along with the property that $\delta_L(r,m)$ is increasing in r under Assumption 2, imply that $d\mathcal{V}(r)/dr > 0$. That player L is better off in the low information-intensity equilibrium then follows from the fact that $r(\rho_2) < r(\rho_1)$, which in turn follows from the fact that, under the conditions in the proposition $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger \in [\rho_1, \rho_2]$, as established in Proposition 1, along with Assumption 3, and

Condition (3). ■

Proof of Proposition 4. (i) The logic is similar to the one behind Proposition 3. Consider a pure-strategy equilibrium of the game without disclosure in which L selects ρ^*. We want to show that ρ^* can also be supported in a pure-strategy equilibrium of the game with disclosure. To see this, for any $\hat{\rho} \in \mathbb{R}_+$, let $e(\hat{\rho})$ denote the choice of information by L when disclosing $\hat{\rho}$. Consider the following strategy for L in the game with disclosure. For any $\hat{\rho} \leq \rho^*$, $e(\hat{\rho}) = \rho^*$, whereas for any $\hat{\rho} > \rho^*$, $e(\hat{\rho}) \geq \hat{\rho}$ (the precise value is not important). Under Assumption 3, that $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger$ implies that F's reaction $r(\rho^\dagger)$ is non-increasing in the choice $\rho^\dagger$ anticipated by F. Hence, for any $\hat{\rho} > \rho^*$, F's reaction is $r(e(\hat{\rho})) \leq r^* \equiv r(\rho^*)$, whereas, for any $\hat{\rho} \leq \rho^*$, F's reaction is $r(e(\hat{\rho})) = r^*$. These properties imply that

$$\sup_{\{\rho,\hat{\rho}\}} \left\{ \int_{-\infty}^{m^*(r(e(\hat{\rho})))} \delta_L(r(e(\hat{\rho})), m) dG(m;\rho) - C(\rho) \right\} = \int_{-\infty}^{m^*(r^*)} \delta_L(r^*, m) dG(m;\rho^*) - C(\rho^*),$$

where the equality follow from the fact that ρ^* is an equilibrium of the no-disclosure game along with the fact that L's payoff is increasing in r by Assumption 2.

(ii) Conversely, let ρ^* be an information choice supported by a regular equilibrium of the disclosure game (with associated disclosure $\hat{\rho}(\rho^*) \leq \rho^*$ and reaction $r^* \equiv r(\rho^*)$). Suppose that $\rho^* < \underline{\rho}$, where $\underline{\rho}$ is the lowest equilibrium level of the no-disclosure game. That the equilibrium supporting ρ^* is regular, along with the fact that $r(\cdot)$ is non-increasing in $\rho^\dagger$ (by virtue of the assumption that $\mathrm{A}(\rho^\dagger) < 0$ for all $\rho^\dagger$) implies that, for any $\hat{\rho} <\hat{\rho}(\rho^*)$, $e(\hat{\rho}) = \rho^*$ and hence $r(e(\hat{\rho})) = r^*$—otherwise, L has a profitable deviation—and that, for any $\hat{\rho} > \hat{\rho}(\rho^*)$, $e(\hat{\rho}) \geq \rho^*$ and hence $r(e(\hat{\rho})) \leq r^*$. Hence, given any actual choice ρ, the most profitable disclosure for player L induces a reaction r^*. This means that, under the reaction r^*, the payoff that L obtains by selecting ρ^* is weakly higher than the payoff that she obtains by selecting any other level ρ. Therefore, ρ^* can also be sustained in the no-disclosure game, a contradiction. Similar arguments imply that the highest level of ρ that can be sustained in any regular equilibrium of the disclosure game is $\bar{\rho}$, where $\bar{\rho}$ is the largest equilibrium level in the no-disclosure

game. ■

Proof of Proposition 5. As explained in the main text, we consider here a more general setting in which L's payoff differential is an arbitrary function $\delta_L(r, m)$ satisfying Assumption 2, and in which F is a representative of a competitive market with arbitrary payoff differential $\delta_F(r, m) \equiv u_F(1,\, r,\, m) - u_F(0,\, m)$. Hence, $u_F(1,\, r,\, m)$ is F's payoff from responding with reaction r to L's choice of engaging, when the posterior mean (equivalently, the state) is m, whereas $u_F(0,\, m)$ is her payoff in case L does not engage. The payoff functions $\delta_L(r, m)$ and $\delta_F(r, m)$, as well as the distributions $G(m; \rho)$, are differentiable and equi-Lipschitz-continuous. As indicated in the main text, we also maintain that, for any s, the equilibrium choices $\rho^*(s)$ and $r^*(s)$ are unique, Lipschitz continuous, and differentiable, and the welfare function

$$W(s) \equiv \int_{-\infty}^{m^*(r^*(s),s)} (\delta_L(r^*(s), m) + s)\, dG(m; \rho^*(s)) - C(\rho^*(s)) - (1+\lambda) s G(m^*(r(s), s); \rho^*(s)$$

is quasi-concave. Note that, under the more general payoff functions introduced above, for any r and s, the engagement threshold $m^*(r, s)$ is implicitly defined by the solution to $\delta_L(r, m^*) + s = 0$ and the follower's reaction $r^*(s)$ satisfies

$$\int_{-\infty}^{m^*(r^*(s),s)} \delta_F(r^*(s), m) dG(m; \rho^*(s)) = 0.$$

Lemma 1. Suppose the environment satisfies the conditions above and Assumptions 2 and 3 hold. There exists a threshold $K > 0$ such that a strictly positive subsidy is optimal if $\frac{d}{ds} M^-(m^*(r^*(0), s); \rho^*(s))\big|_{s=0} > K$, whereas a tax on engagement is optimal when the above inequality is reversed.[24]

[24] As the proof below shows, in the anti-lemons case (i.e., when Assumption 3 is replaced by Assumption A3' in the Supplement), the conclusion in the Lemma flips as follows: there exists a negative threshold $K < 0$ such that a strictly positive subsidy is optimal if $\frac{d}{ds} M^-(m^*(r^*(0), s); \rho^*(s))\big|_{s=0} < K$, whereas a tax on engagement is optimal when the above inequality is reversed.

Proof of Lemma 1. Using the envelope theorem, we have that[25]

$$W'(s) = \int_{-\infty}^{m^*(r^*(s),s)} \left[\frac{\partial \delta_L(r^*(s),m)}{\partial r} \frac{dr^*(s)}{ds} + 1 \right] dG(m;\rho^*(s)) - \frac{d}{ds} \left[(1+\lambda) s G(m^*(r^*(s),s);\rho^*(s)) \right].$$

The first line is simply the effect of a change in the subsidy on the leader's expected payoff (holding $\rho^*(s)$ and $m^*(r^*(s),s)$ fixed by usual envelope-theorem arguments). The second line is the (total) effect of a change in the subsidy on the cost of the program to the government. Note that $W^{'}(s)$ can be expressed as

$$W^{'}(s) = \frac{dr^*(s)}{ds} \int_{-\infty}^{m^*(r^*(s),s)} \frac{\partial \delta_L(r^*(s),m)}{\partial r} dG(m;\rho^*(s)) - s(1+\lambda) \frac{d}{ds} \left[G(m^*(r^*(s),s);\rho^*(s)) \right] \\ -\lambda G(m^*(r^*(s),s);\rho^*(s)).$$

Because $W(s)$ is quasi-concave in s, the optimal s is strictly positive when

$$W^{'}(0) = \frac{dr^*(0)}{ds} \int_{-\infty}^{m^*(r^*(0),0)} \frac{\partial \delta_L(r^*(0),m)}{\partial r} dG(m;\rho^*(0)) - \lambda G(m^*(r^*(0),0);\rho^*(0)) > 0$$

and strictly negative when the above inequality is reversed.

Because δ_L is affine in m, it can be expressed as $\delta_L(r,m) = a_L(r)m + b_L(r)$, for some functions $a_L(r)$ and $b_L(r)$. Assumption 2 then implies that, for any (r,m), $a_L(r) < 0$ and $a_L'(r)m + b_L'(r) > 0$. This means that $W^{'}(0) > 0$ when $dr^*(0)/ds > r^{\#}$, whereas $W'(0) < 0$ when $dr^*(0)/ds < r^{\#}$, where $r^{\#} \equiv \lambda \left[\frac{\partial}{\partial r} \delta_L(r^*(0), M^-(m^*(r^*(0),0);\rho^*(0)) \right]^{-1}$ is a strictly positive constant that depends on the primitives of the problem. For example, in the Akerlof model, $\delta_L(r,m) = r - m$, in which case $r^{\#} = \lambda$. Because δ_F is affine in m, it can be expressed as $\delta_F(r,m) = a_F(r)m + b_F(r)$, for some functions $a_F(r)$ and $b_F(r)$, with $a_F(r) > 0$ when Assumption 3 holds (lemons), and $a_F(r) < 0$ when Assumption 3' in the Supplement holds (anti-lemons).[26] Hence, for any s, $r^*(s)$ solves

[25] Here we are using the fact that, given s and $r^*(s)$, $m^*(r^*(s),s)$ and $\rho^*(s)$ maximize the leader's payoff $\int_{-\infty}^{\hat{m}} (\delta_L(r^*(s),m) + s)\, dG(m;\rho) - C(\rho)$ over $(\hat{m},\rho)$.

[26] To see this, note that, for any m^*, ρ, and r, $\int_{-\infty}^{m^*} \delta_F(r,m) dG(m;\rho) = G(m^*;\rho)\delta_F(r, M^-(m^*;\rho))$. Now fix s and drop it. The equilibrium r thus solves $a_F(r)M^-(m^*(r);\rho) + b_F(r) = 0$. Hence,

$$\frac{dr}{d\rho} = -\frac{a_F(r) \frac{\partial}{\partial \rho} M^-(m^*(r);\rho)}{\frac{\partial}{\partial r} \delta_F(r, M^-(m^*(r);\rho))}.$$

$\delta_F(r^*, M^-(m^*(r^*, s); \rho^*(s))) = 0$. Using the implicit-function theorem, we have that

$$\frac{dr^*(s)}{ds} = -\frac{\frac{d}{ds}\delta_F(r, M^-(m^*(r, s); \rho^*(s)))\big|_{r=r^*(s)}}{\frac{d}{dr}\delta_F(r, M^-(m^*(r, s); \rho^*(s)))\big|_{r=r^*(s)}}$$

where the denominator is negative, by assumption. Hence, $dr^*(0)/ds > r^{\#}$ if

$$\frac{d}{ds}\delta_F(r^*(0), M^-(m^*(r^*(0), s); \rho^*(s)))\Big|_{s=0} > \Lambda \equiv \lambda \left| \frac{\frac{d}{dr}\delta_F(r, M^-(m^*(r, 0); \rho^*(0)))\big|_{r=r^*(0)}}{\frac{d}{dr}\delta_L(r, M^-(m^*(r, 0); \rho^*(0)))\big|_{r=r^*(0)}} \right|$$

whereas $dr^*(0)/ds < r^{\#}$ if the above inequality is reversed. The condition says that, at the laissez-faire equilibrium, holding the follower's reaction fixed at $r^*(0)$, a small subsidy to engagement has a strong enough positive effect on the follower's payoff, accounting for the effect that the subsidy has on both the leader's engagement threshold and her choice of information. Clearly,

$$\frac{d}{ds}\delta_F(r^*(0), M^-(m^*(r^*(0), s); \rho^*(s)))\Big|_{s=0} = a_F(r^*(0))\ \frac{d}{ds}M^-(m^*(r^*(0), s); \rho^*(s))\Big|_{s=0}.$$

The result in the lemma then follows by letting $K \equiv \Lambda/a_F(r^*(0))$ and noting that $K > 0$ when $a_F(r^*(0)) > 0$, i.e., when Assumption 3 (lemons) holds, whereas $K < 0$ when $a_F(r^*(0)) < 0$, i.e., when Assumption 3' in the Supplement (anti-lemons) holds. □

Now to see how the lemma, when applied to the Akerlof model, implies the result in the proposition, observe that, in this case, $\Lambda = \lambda$ and $a_F(r^*(0)) = 1$, implying that $K = \lambda$, and

$$\tfrac{d}{ds}M^-(m^*(r^*(0), s); \rho^*(s))\big|_{s=0} = \tfrac{\partial}{\partial m^*}M^-(r^*(0); \rho^*(0)) + \tfrac{\partial}{\partial \rho}M^-(r^*(0); \rho^*(0))\tfrac{d\rho^*(0)}{ds}.$$

■

The denominator in the above expression is negative, by assumption. It follows that $dr/d\rho \overset{\text{sgn}}{=} a_F(r)\frac{\partial}{\partial \rho}M^-(m^*(r); \rho)$. Hence, $a_F(r) > 0$ when Assumption 3 holds, whereas $a_F(r) < 0$ when Assumption 3' in the Supplement holds.

Proof of Proposition 6. As in the proof of Proposition 5, we consider a more general settings in which L's payoff differential is $\delta_L(r, m)$, with δ_L satisfying Assumption 2, and in which F is a representative of a competitive market with payoff differential $\delta_F(r, m) \equiv u_F(1, r, m) - u_F(0, m)$, with $\delta_L(r, m)$, $\delta_F(r, m)$ and $G(m; \rho)$ differentiable and equi-Lipschitz continuous.

For any s, let $\hat{r}(s)$ denote F's equilibrium reaction when the subsidy is equal to s and information is exogenous and equal to $\rho^*(s^*)$, where s^* is the optimal policy when information is endogenous. Clearly, for $s = s^*$, $\hat{r}(s^*) = r^*(s^*)$, where $r^*(s^*)$ is the equilibrium reaction when information is endogenous. Recall that, for any r and s, the engagement threshold $m^*(r, s)$ is implicitly defined by the solution to $\delta_L(r, m) + s = 0$, and that, for any s, when $\rho = \rho^*(s^*)$, the follower's reaction $\hat{r}(s)$ satisfies $\int_{-\infty}^{m^*(\hat{r}(s),s)} \delta_F(\hat{r}(s), m) dG(m; \rho^*(s^*)) = 0$. For any (r, s), then let

$$\hat{W}(r, s) \equiv \int_{-\infty}^{m^*(r,s)} (\delta_L(r, m) + s)\, dG(m; \rho^*(s^*)) - C(\rho^*(s^*)) - (1+\lambda) s G(m^*(r, s); \rho^*(s^*))$$

denote the level of welfare that is attained when information is exogenous and equal to $\rho = \rho^*(s^*)$, F's reaction is r, the subsidy is s, and L engages if and only if $m < m^*(r, s)$.

Lemma 2. The subsidy is larger under endogenous information (i.e., $s^* > s^{**}$) if

$$\left(\frac{d\hat{r}(s^*)}{ds} - \frac{dr^*(s^*)}{ds} \right) \frac{\partial \hat{W}(r^*(s^*), s^*)}{\partial r} + (1 + \lambda) s^* G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) \frac{d\rho^*(s^*)}{ds} < 0.$$

It is smaller (i.e., $s^* < s^{**}$) if the above inequality is reversed.

Proof of Lemma 2. Under the maintained assumptions that both W and $W^\#$ are quasi-concave, the optimal value of s^* solves

$$\begin{aligned}\tfrac{dW(s^*)}{ds} &= \tfrac{dr^*(s^*)}{ds}\textstyle\int_{-\infty}^{m^*(r^*(s^*),s^*)} \tfrac{\partial \delta_L(r^*(s^*),m)}{\partial r} dG(m;\rho^*(s^*)) \\ -(1+\lambda)s^* g(m^*(r^*(s^*),s^*);\rho^*(s^*))&\left[\tfrac{\partial m^*(r^*(s^*),s^*)}{\partial r}\tfrac{dr^*(s^*)}{ds} + \tfrac{\partial m^*(r^*(s^*),s^*)}{\partial s}\right] \\ -(1+\lambda)s^*\tfrac{d\rho^*(s^*)}{ds}&G_\rho(m^*(r^*(s^*),s^*);\rho^*(s^*)) - \lambda G(m^*(r^*(s^*),s^*);\rho^*(s^*)) = 0.\end{aligned} \tag{12}$$

Use the envelope theorem along with the fact that $\hat{r}(s^*) = r^*(s^*)$ and, for any s, $W^{\#}(s) = \hat{W}(\hat{r}(s), s)$, to observe that

$$\frac{dW^{\#}(s^*)/ds}{ds} = \frac{\partial \hat{W}(r^*(s^*),s^*)}{\partial r}\frac{d\hat{r}(s^*)}{ds} + \frac{\partial \hat{W}(r^*(s^*),s^*)}{\partial s}$$

where

$$\begin{aligned}\tfrac{\partial \hat{W}(r^*(s^*),s^*)}{\partial r} &= \textstyle\int_{-\infty}^{m^*(r^*(s^*),s^*)} \tfrac{\partial \delta_L(r^*(s^*),m)}{\partial r} dG(m;\rho^*(s^*)) \\ &-(1+\lambda)s^* g(m^*(r^*(s^*),s^*);\rho^*(s^*))\tfrac{\partial m^*(r^*(s^*),s^*)}{\partial r}\end{aligned}$$

and

$$\begin{aligned}\tfrac{\partial \hat{W}(r^*(s^*),s^*)}{\partial s} &= -(1+\lambda)s^* g(m^*(r^*(s^*),s^*);\rho^*(s^*))\tfrac{\partial m^*(r^*(s^*),s^*)}{\partial s} \\ &-\lambda G(m^*(r^*(s^*),s^*);\rho^*(s^*)).\end{aligned}$$

Using (12), we thus have that

$$\tfrac{dW^{\#}(s^*)}{ds} = \left(\tfrac{d\hat{r}(s^*)}{ds} - \tfrac{dr^*(s^*)}{ds}\right)\tfrac{\partial \hat{W}(r^*(s^*),s^*)}{\partial r} + (1+\lambda)s^*\tfrac{d\rho^*(s^*)}{ds}G_\rho(m^*(r^*(s^*),s^*);\rho^*(s^*)).$$

Because $W^{\#}(s)$ is strictly quasi-concave and because s^{**} is obviously finite, we then have that $s^{**} < s^*$ if $dW^{\#}(s^*)/ds < 0$ and $s^{**} > s^*$ if the above inequality is reversed. □

Next observe that the optimality of s^* when information is endogenous implies that

$$\begin{aligned}\tfrac{dr^*(s^*)}{ds}\tfrac{\partial \hat{W}(r^*(s^*),s^*)}{\partial r} &= (1+\lambda)s^* g(m^*(r^*(s^*),s^*);\rho^*(s^*))\tfrac{\partial m^*(r^*(s^*),s^*)}{\partial s} \\ +\lambda G(m^*(r^*(s^*),s^*);\rho^*(s^*)) &+ (1+\lambda)s^*\tfrac{d\rho^*(s^*)}{ds}G_\rho(m^*(r^*(s^*),s^*);\rho^*(s^*)).\end{aligned}$$

Hence, when (A) $s^* > 0$, (B) $dr^*(s^*)/ds > 0$, and (C) $\tfrac{d\rho^*(s^*)}{ds}G_\rho(m^*(r^*(s^*),s^*);\rho^*(s^*)) > 0$, necessarily $\partial \hat{W}(r^*(s^*),s^*)/\partial r > 0$. That is, under the welfare-maximizing policy

s^*, welfare always increases with r when more information reduces the probability of engagement (i.e., when $G_\rho(m^*(r(s^*), s^*); \rho^*(s^*)) < 0$) and the comparative statics of the equilibrium r and ρ have the same monotonicity as those of the best responses (i.e., r^* increases and ρ^* decreases with s). Also note that

$$\frac{dr^*(s^*)}{ds} - \frac{d\hat{r}(s^*)}{ds} \overset{\text{sgn}}{=} \frac{\partial \delta_F(r^*(s^*), m)}{\partial m} \frac{\partial}{\partial \rho} M^-(m^*(r^*(s^*), s^*); \rho^*(s^*)) \frac{d\rho^*(s^*)}{ds},$$

where $\partial \delta_F(r^*(s^*), m)/\partial m$ is invariant in m under the maintained assumption that δ_F is affine in m. Hence, in the lemons case (i.e., when Assumption 3 holds, in which case $\partial \delta_F(r^*(s^*), m)/\partial m > 0$), an increase in s leads to a larger response by F under endogenous information when

$$\frac{\partial}{\partial \rho} M^-(m^*(r^*(s^*), s^*); \rho^*(s^*)) \frac{d\rho^*(s^*)}{ds} > 0 \tag{13}$$

and a smaller response when the inequality is reversed. That is, F responds more to an increase in the subsidy under endogenous information when the increase leads to a reduction in information acquisition and, as a result of it, an alleviation of the adverse selection problem. The opposite conclusions holds in the anti-lemons case (i.e., under Assumption 3' in the Supplement, in which case $\partial \delta_F(r^*(s^*), m)/\partial m < 0$).

To see how the above results, when applied to the Akerlof model, imply the claim in the proposition, observe that, in the Akerlof model,

$$\frac{d\hat{r}(s^*)}{ds} - \frac{dr(s^*)}{ds} = \frac{\frac{\partial}{\partial \rho} M^-(m^*(r^*(s^*), s^*); \rho^*(s^*)) \frac{d\rho^*(s^*)}{ds}}{\frac{\partial}{\partial m^*} M^-(m^*(r^*(s), s^*); \rho^*(s^*)) - 1}.$$

Using the fact that

$$\frac{\partial}{\partial \rho} M^-(m^*; \rho) = \frac{G_\rho(m^*; \rho)[m^* - M^-(m^*; \rho)] - \int_{-\infty}^{m^*} G_\rho(m; \rho) dm}{G(m^*; \rho)}$$

and $\frac{\partial}{\partial m^*} M^-(m^*; \rho) = g(m^*; \rho)[m^* - M^-(m^*; \rho)]/G(m^*; \rho)$, along with the fact that

$m^*(r^*(s^*), s^*) = r^*(s^*) + s^*$ and $r^*(s^*) = M^-(m^*(r^*(s^*), s^*); \rho^*(s^*)) + \Delta$, we have that

$$\frac{d\hat{r}(s^*)}{ds} - \frac{dr(s^*)}{ds} = \left((s^* + \Delta) G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) - \int_{-\infty}^{m^*(r^*(s^*), s^*)} G_\rho(m; \rho^*(s^*)) dm\right) \frac{\frac{d\rho^*(s^*)}{ds}}{D},$$

where

$$D \equiv (s^* + \Delta) g(m^*(r^*(s^*), s^*); \rho^*(s^*)) - G(m^*(r^*(s^*), s^*); \rho^*(s^*)) < 0 \tag{14}$$

when $G(m; \rho)/g(m; \rho)$ is increasing in m at $\rho = \rho^*(s^*)$. Hence, when, in addition to this last condition, information structures are consistent with the MPS order, $d\rho^*(s^*)/ds < 0$, and $G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) < 0$, we have that $d\hat{r}(s^*)/ds - dr(s^*)/ds < 0$. Furthermore, in this case,

$$\frac{\partial \hat{W}(r^*(s^*), s^*)}{\partial r} = G(m^*(r^*(s^*), s^*); \rho^*(s^*)) - (1 + \lambda) s^* g(m^*(r^*(s^*), s^*); \rho^*(s^*)).$$

Using the fact that

$$\frac{dW^\#(s^*)}{ds} = \left(\frac{d\hat{r}(s^*)}{ds} - \frac{dr^*(s^*)}{ds}\right) \frac{\partial \hat{W}(r^*(s^*), s^*)}{\partial r} + (1 + \lambda) s^* \frac{d\rho^*(s^*)}{ds} G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*))$$

as established in Lemma 2, we then have that $dW^\#(s^*)/ds = \frac{d\rho(s^*)}{ds} \frac{J}{D}$, where

$$\begin{aligned} J \equiv (\Delta - \lambda s^*) \, & G_\rho(m^*(r^*(s^*), s^*); \rho^*(s^*)) G(m^*(r^*(s^*), s^*); \rho^*(s^*)) \\ & + \left(\int_{-\infty}^{m^*(r^*(s^*), s^*)} G_\rho(m; \rho^*(s^*)) dm\right) \times \\ \times \, & \left[(1 + \lambda) s^* g(m^*(r^*(s^*), s^*); \rho^*(s^*)) - G(m^*(r^*(s^*), s^*); \rho^*(s^*))\right]. \end{aligned}$$

Note that $J < 0$ when information structures are consistent with the MPS order, $G(m; \rho)/g(m; \rho)$ is increasing in m, and $G_\rho(m; \rho) < 0$.[27]

[27] Under the optimal subsidy s^*, welfare is equal to $G(m^*(r^*(s^*), s^*); \rho^*(s^*)) (\Delta - \lambda s^*) - C(\rho^*(s^*))$. Because welfare is non-negative under the laissez-faire equilibrium, it must be that $\Delta > \lambda s^*$. Furthermore, when $\Delta > \lambda s^*$, $(1 + \lambda) s^* g(m^*(r^*(s^*), s^*); \rho^*(s^*)) - G(m^*(r^*(s^*), s^*); \rho^*(s^*)) < D$, where D is as in (14). Hence, the second line in J is negative when information structures are consistent with the MPS order and $G(m; \rho^*(s^*))/g(m; \rho^*(s^*))$ is increasing in m.

We conclude that, under the assumptions in the proposition, $dW^{\#}(s^*)/ds \overset{\text{sgn}}{=} d\rho(s^*)/ds$. To see that, under the assumptions in the proposition, $d\rho(s^*)/ds < 0$, note that

$$\frac{dr^*(s)}{ds} = -\frac{\frac{\partial M^-(m^*(r^*(s),s);\rho^*(s))}{dm^*} + \frac{\partial M^-(m^*(r^*(s),s);\rho^*(s))}{d\rho}\frac{d\rho^*(s)}{ds}}{\frac{\partial M^-(m^*(r^*(s),s);\rho^*(s))}{dm^*} - 1}.$$

Under the assumptions in the proposition,

$$\frac{\partial M^-(m^*(r^*(s),s);\rho^*(s))}{dm^*} - 1 = D \cdot G(m^*(r^*(s^*),s^*);\rho^*(s^*)) < 0$$

where D is as in (14). Furthermore, $\partial M^-(m^*(r^*(s),s);\rho^*(s))/d\rho < 0$. Hence, $dr^*(s)/ds < 0$ if $d\rho(s^*)/ds > 0$. This cannot be consistent with the optimality of s^*. In fact, by cutting the subsidy, the planner would induce a friendlier reaction by F and a smaller investment in information by L, while also saving on the costs of public funds. The optimality of s^* thus implies that $d\rho(s^*)/ds < 0$. We conclude that $dW^{\#}(s^*)/ds < 0$. The strict quasi-concavity of $W^{\#}$ then implies that $s^{**} < s^*$. ■

Proof of Proposition 7. (i) The proof follows from the same arguments that establish part (i) of Proposition 1. (ii) Recall that

$$\frac{\partial}{\partial\rho}M^-\left(m^*(r(\rho^\dagger));\,\rho,r(\rho^\dagger)\right) = \frac{\partial}{\partial\rho}\left(\int \omega\frac{q^{\rho,r(\rho^\dagger)}(1|\omega)}{q^{\rho,r(\rho^\dagger)}(1)}dG(\omega)\right).$$

Under both entropy and max-slope, $q^{\rho,r(\rho^\dagger)}(1|\omega)/q^{\rho,r(\rho^\dagger)}(1)$ is a decreasing function of ω. Hence, when $q^{\rho,r(\rho^\dagger)}(1|\omega)/q^{\rho,r(\rho^\dagger)}(1)$ is increasing in ρ for $\omega < m^*(r(\rho^\dagger))$ and decreasing in ρ for $\omega > m^*(r(\rho^\dagger))$, the family of distributions $\left(F^{\rho,r(\rho^\dagger)}\right)_\rho$, indexed by ρ, with each cdf $F^{\rho,r(\rho^\dagger)}$ defined by the density $f^{\rho,r(\rho^\dagger)}(\omega) \equiv q^{\rho,r(\rho^\dagger)}(1|\omega)g(\omega)/q^{\rho,r(\rho^\dagger)}(1)$ can be ranked according to FOSD, with $F^{\rho,r(\rho^\dagger)} \succ F^{\rho',r(\rho^\dagger)}$ for any $\rho < \rho'$. This means that $M^-(m^*(r(\rho^\dagger));\,\rho,r(\rho^\dagger))$ is decreasing in ρ at $\rho = \rho^\dagger$, which implies that $\mathrm{A}(\rho^\dagger) < 0$—information aggravates adverse selection. (iii) Note that

$$\frac{\partial\Pi(\rho;r(\rho^\dagger))}{\partial r} = q^{\rho,r(\rho^\dagger)}(1)\int\frac{\partial\delta_L(r(\rho^\dagger),\omega)}{\partial r}\frac{q^{\rho,r(\rho^\dagger)}(1|\omega)}{q^{\rho,r(\rho^\dagger)}(1)}dG(\omega). \tag{15}$$

Under Assumption 2, $\partial\delta_L(r(\rho^\dagger),\omega)/\partial r$ is increasing in ω. Hence, when $q^{\rho,r(\rho^\dagger)}(1|\omega)/q^{\rho,r(\rho^\dagger)}(1)$ is increasing in ρ for $\omega < m^*(r(\rho^\dagger))$ and decreasing in ρ for $\omega > m^*(r(\rho^\dagger))$, the integral term in (15) is decreasing in ρ (the arguments are the same as in part (ii)). Therefore, a sufficient condition for $B(\rho;\rho^\dagger) = -\partial^2\Pi(\rho;r(\rho^\dagger))/\partial\rho\partial r$ to be positive is that, in addition to $q^{\rho,r(\rho^\dagger)}(1|\omega)/q^{\rho,r(\rho^\dagger)}(1)$ to be increasing in ρ for $\omega < m^*(r(\rho^\dagger))$ and decreasing in ρ for $\omega > m^*(r(\rho^\dagger))$, $q^{\rho,r(\rho^\dagger)}(1)$ is weakly decreasing in ρ.

(iv) The proof follows from the fact that, in this case,

$$B(\rho;\rho^\dagger) = -\left(\frac{\partial}{\partial r}\delta_L\Big(r(\rho^\dagger), m^*(r(\rho^\dagger))\Big)\right) G_\rho\Big(m^*\big(r(\rho^\dagger)\big);\rho,r(\rho^\dagger)\Big).$$

Because $\mathrm{A}(\rho^\dagger) < 0$, the result in part (i) implies that a necessary and sufficient condition for expectation conformity to hold at $(\rho,\rho^\dagger)$ is that $B(\rho;\rho^\dagger) > 0$ which is the case if and only if $G_\rho\Big(m^*\big(r(\rho^\dagger)\big);\rho,r(\rho^\dagger))\Big) < 0$. Because, for any ρ,

$$G\Big(m^*\big(r(\rho^\dagger)\big);\rho,r(\rho^\dagger))\Big) = \int q^{\rho,r(\rho^\dagger)}(1|\omega)dG(\omega) \equiv q^{\rho,r(\rho^\dagger)}(1)$$

the latter property is equivalent to $q^{\rho,r(\rho^\dagger)}(1)$ being non-increasing in ρ. ■

Proof of Proposition 8. Acquiring no information and withholding the asset is optimal for L if and only if $r \leq \underline{r}(\rho)$. In turn, the lowest price consistent with F's rationality is $r = \underline{\omega} + \Delta$. These equilibria thus exist if and only if $\underline{\omega} + \Delta \leq \underline{r}(\rho)$. Note that $\underline{r}(\cdot)$ is decreasing, satisfying $\lim_{\rho\to 0^+}\underline{r}(\rho) = \omega_0$ and $\lim_{\rho\to+\infty}\underline{r}(\rho) = \underline{\omega}$. It follows that there exists $\underline{\rho}(G,\Delta) > 0$ such that $\underline{\omega} + \Delta \leq \underline{r}(\rho)$ if and only if $\rho \leq \underline{\rho}(G,\Delta)$. ■

Proof of Proposition 9. L finds it optimal to put the asset on sale without acquiring information if and only if $r \geq \bar{r}(\rho)$. In turn, the only price consistent with F's rationality when L follows this strategy is $r = \omega_0 + \Delta$. Hence, these equilibria exist if and only if $\omega_0 + \Delta \geq \bar{r}(\rho)$. Because $\bar{r}(\cdot)$ is increasing, satisfying $\lim_{\rho\to 0^+}\bar{r}(\rho) = \omega_0$ and $\lim_{\rho\to+\infty}\bar{r}(\rho) = \bar{\omega}$, when $\omega_0 + \Delta < \bar{\omega}$, there exists $\bar{\rho}(G,\Delta) > 0$ such that $\omega_0 + \Delta \geq \bar{r}(\rho)$ if and only if $\rho \leq \bar{\rho}(G,\Delta)$. ■