The Taxation of Bilateral Trade with Endogenous Information*  

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Abstract  
This paper shows that a profit tax and a transaction tax have opposite implications for information acquisition and trade in decentralized markets. A transaction tax increases the incentive to acquire private information. It reduces the probability of trade in equilibrium with information acquisition and adverse selection. Furthermore, a transaction tax increases the range of information costs where equilibrium exhibits adverse selection. The exact opposite holds for a profit tax. Consequently, in markets where there are gains from trade (such as debt funding markets) a transaction tax is welfare reducing and dominated by a profit tax.  

\textit{Keywords}: Bargaining; information acquisition; taxation, transaction tax,  

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1. INTRODUCTION

In this paper we analyze the impact of taxation on information acquisition and trade in decentralized markets. We show that a tax on profits (capital gains) and a transaction tax have opposite implications. A transaction tax increases the incentive to acquire private information. It reduces the probability of trade in equilibrium with information acquisition and adverse selection (e.g. when information cost is low). As an indirect effect, a transaction tax increases the range of information costs where equilibrium exhibits information acquisition and adverse selection. The exact opposite holds for a profit tax. In markets where there are gains from trade and private information acquisition creates endogenous lemons problems a profit tax dominates a transaction tax.

Our results contribute to the recent discussions about the taxation of the financial sector by demonstrating that the welfare effects of taxation depend on the type of tax instruments if information asymmetries are endogenous. Since financial investors typically decides how much information they want to learn, information is inherently endogenous, especially in secondary markets. Therefore, understanding the equilibrium incentive effects of taxation on information acquisition and bargaining behavior at the trading level is important for policy design.

This paper is at the intersection of two large but disconnected literatures, the taxation and bargaining literatures. The discussion of the taxation of financial transactions dates back to Tobin (1978) and his proposal of a tax on foreign exchange markets. Originally proposed in the context of exchange rate systems, the discussion about the “Tobin tax” has subsequently been generalized to a financial transaction tax. Stiglitz (1989) and Summers and Summers (1989) advocate a financial transaction tax as a way to reduce speculative investments, but this view has also been disputed (Ross 1989). The literature on tax incidence analyzes the conditions that determine the distribution of the burden of taxation among market participants and typically focuses on complete information (Fullerton and Metcalf 2002). Questions of tax incidence with exogenous asymmetric information have been analyzed in competitive markets.

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A key insight of the bargaining and contracting literature is that equilibrium outcomes are typically not efficient when agents have private information (Ausubel, Cramton and Deneckere 2002). However, in many bilateral transactions in secondary markets there is asymmetry in the agents’ cost or ability to acquire information rather than asymmetry in the information that agents possess ex ante. There are a few papers that analyze information acquisition in bargaining and optimal contracting. Crémer and Khalil (1992) and Crémer, Khalil and Rochet (1998) show that the equilibrium outcome with endogenous information acquisition can be very different from the equilibrium outcome under exogenous asymmetric information. Dang (2008) considers a bargaining model with common values and shows that the mere possibility of information acquisition can cause efficient trade to break down even though no agent acquires information and maintain symmetric information in equilibrium.

To our knowledge, there is no theoretical work that analyzes the impact of taxation on bargaining. One reason for this might be that (profit) taxation does not alter equilibrium outcomes when private information is exogenous, which is a common assumption in the bargaining and contracting literature. In particular, the effect of taxation on information acquisition has not yet been explored. Our paper hints at an aspect that is novel, namely that taxation can affect trade by influencing the problem of endogenous information asymmetries. By changing the incentives to acquire information, taxation can change the equilibrium price and hence the probability of trade, the parties’ gains from trade and the division of the gains from trade.

We provide a theoretical model to analyze the implications of two common tax instruments for trade in over-the-counter markets. Our model builds on Dang (2008) and Dang, Gorton and Holmstrom (2015a,b) who analyze optimal security design with information acquisition. We use their concept of “information sensitivity” to characterize the properties of equilibrium

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2 The effects of income and commodity taxation in the context of (exogenous) asymmetric information and moral hazard have been studied by Arnott and Stiglitz (1986), Kaplow (1992), Banerjee and Besley (1990) and in the context of signaling by Ireland (1994) and Anderson (1996). Ginsburgh, Legros, and Sahuguet (2010) analyze the incidence effects of commissions in auctions, which can be interpreted as a sales tax.

3 Trade of fixed income instruments are typically not conducted in centralized markets but in over-the-counter markets and are thus of bilateral nature. Examples include government bonds, corporate bonds, syndicated loans, mortgage-backed securities and asset-backed securities. Also, in three of the largest markets, currencies, repos and (interest rate and credit default) swaps are traded bilaterally. Therefore, the workhorse models (Grossman and Stiglitz, 1981, Kyle, 1985 and 1989) in the market microstructure literature on centralized stock trading are less appropriate for studying the effects of taxation in decentralized debt markets.
outcomes in bargaining with information acquisition and taxation. In particular, we analyze the consequences of a transaction tax versus a tax on profits in a setting where two agents negotiate over the price at which to trade an indivisible asset with uncertain value and can acquire information about the payoff of the asset. In order to highlight the effects of taxation we consider a take-it-or-leave-it offer bargaining game that allocates the full bargaining power to one side of the market (the seller or the buyer). Moreover, our main analysis focuses on information acquisition of the responder. An endogenous signaling game in which the proposing agent can acquire information is analyzed in the Appendix.

Our main results show that a transaction tax and profit tax have opposite implications for the equilibrium outcome in bargaining and taxation has a direct and indirect effect. A marginal increase of a profit tax reduces the incentive to acquire private information. In an equilibrium with information acquisition and adverse selection (e.g. when information cost is low), a profit tax increases the probability of trade. Furthermore, it reduces the range of information costs, where equilibrium exhibits adverse selection. The exact opposite holds for a transaction tax. Although the precise mechanism behind our results is more elaborate and differs for the two types of taxes, the main incentive effects are intuitive and can be summarized as follows.

Suppose the seller makes a price offer. Consider a tax on the buyer’s realized profit form trade. In the benchmark case where the buyer has exogenous private information, profit taxation reduces the buyer’s profits from trade but has no effect on the buyer’s decision to trades since the informed buyer always buys if the value is larger than the price. Therefore, the equilibrium price the seller proposes and the probability of trade are both independent of a profit tax. If, however, becoming informed is costly for the buyer, three effects emerge. First, in equilibrium with information acquisition, for the buyer to cover the information costs when part of the profit is taxed, the seller needs to reduce the price and this increases the probability of trade. Second, a lower price reduces the buyer’s incentive to acquire information. Third, changes in the incentives to acquire information also affect the seller’s choice whether to induce information acquisition. It now becomes relatively less expensive to prevent information acquisition of the buyer (which the seller can do by setting a sufficiently low price). Overall, there will be less information acquisition in equilibrium and an increase in the probability of trade and in total welfare in markets where there are gains from trade.

If a transaction tax is imposed, there are again three effects. As a direct effect, a transaction tax makes it more attractive for the buyer to acquire information, as the after tax price is higher and thus also the value of information since the expected loss he can avoid by having
information is larger. In equilibrium with information acquisition, a higher offer price reduces
the probability of trade. As an additional and less obvious effect, the transaction tax affects
the seller’s choice between different prices by making it relatively more expensive for the
seller to propose a price at which the buyer has no incentive to acquire information. These
effects lead to a larger range of information costs where there is information acquisition in
equilibrium which reduces the probability of efficient trade and total welfare.

Furthermore, the qualitative effects of taxation do not depend on whether the seller or the
buyer has the full bargaining power and makes the offer, even though the agents’ incentives to
acquire information are different. A buyer decides to acquire information in order to avoid
buying the asset in low payoff states, while the seller’s incentive to acquire information is to
be able to keep the asset in high payoff states. Perhaps surprisingly, the same effects of profit
taxes and transaction taxes on information acquisition and the probability of trade also hold in
the case where the buyer makes the offer and the seller can acquire information.

The remainder of the paper is organized as follows. The next section introduces the model.
Section 3 provides an equilibrium analysis of the game. Section 4 analyzes the comparative
statics effects of taxation on equilibrium information acquisition and pricing. Section 5
concludes. All proofs are in Appendix A. Appendix B analyzes taxation and endogenous
signaling.

2. THE MODEL

We consider a take-it-or-leave-it offer bargaining game with two agents: a seller $S$ and a buyer
$B$. The seller can sell an indivisible asset with uncertain payoff $x$ at a price $p$ to the buyer. Ex
ante the information is symmetric; it is common knowledge that the payoff $x$ is distributed
according to the distribution function $F$ on the interval $[x_L, x_H]$ where $0 \leq x_L < x_H$. $F$ is
assumed to be continuous and differentiable on $[x_L, x_H]$.

The analysis below subsumes two cases: In one case, the seller is the proposer $P$; in the other
case, the buyer is the proposer. The proposing agent (he) offers a price $p$. The other agent (the
responder $R$) observes this price, decides whether to acquire information about the asset, and
then decides whether to trade at price $p$. If the responder (she) decides to acquire information,
she learns the true realization of $x$ at cost $\gamma \geq 0$.

The ex post utility of agent $i = S, B$ is given by

$$U_i = u_i(x, p, \tau, \kappa, q) - \gamma \cdot 1_{\text{info}}, \ i = S, B,$$
where $q \in \{0,1\}$ indicates whether there is trade ($q = 1$ if the asset is traded and $q = 0$ otherwise), $\tau$ is the profit tax rate, $\kappa$ is the transaction tax, and the indicator variable $1_{\text{info}}$ indicates whether the responding agent $i$ has acquired information. Specifically, we assume that

$$u_s(x,p,\tau,\kappa,q) = \begin{cases} 
p - \tau \max\{ p - p_0, 0 \} & \text{if trade } (q = 1) \\
v_s(x) - \tau \max\{ x - p_0, 0 \} & \text{if not trade } (q = 0) 
\end{cases}$$

and

$$u_b(x,p,\tau,\kappa,q) = \begin{cases} 
v_b(x) - (p + \kappa) - \tau \max\{ x - (p + \kappa), 0 \} & \text{if trade } (q = 1) \\
0 & \text{if not trade } (q = 0). 
\end{cases}$$

Here, $v_i(x)$ is agent $i$’s valuation of the asset, which is continuous, strictly increasing and linear in the asset’s payoff $x$. Both agents are risk neutral with respect to the asset’s payoff. Furthermore, we make the following assumption:

$$v_x(x) < v_B(x) \text{ for all } x \in (x_L,x_H).$$

This assumption implies that (for all $x > 0$) trade is efficient since the buyer derives a higher value from holding the asset than the seller so that in the first best the parties should trade with probability one and without information acquisition.

The transaction tax $\kappa \geq 0$ is levied on the buyer and increases the (effective) tax-inclusive price to be paid by the buyer from $p$ to $p + \kappa$. The tax $\tau \in [0,1)$ is a tax rate on positive realized profits. The buyer realizes a positive profit if he buys the asset and the payoff of the asset turns out to be larger than the price $p$. The seller realizes a positive profit either if he does not sell the asset and realizes a payoff $x$ that is larger than some price $p_0$ that he initially paid for the asset (the ‘book value’) or if he sells the asset and receives a price $p$ that is larger than $p_0$.

When considering effects of profit taxation we focus on the side of the market that can acquire information and, hence, ignore taxation of the proposing agent’s profits for simplicity.

Given $u_s(x,p,\tau,\kappa,q)$ and $u_b(x,p,\tau,\kappa,q)$, the outside option of the seller is

$$\pi_s := E_x[u_s(x,p,\tau,\kappa,0)] = E_x[v_s(x)] - E_x[\tau \max\{ x - p_0, 0 \}]$$

An example is $v_B = ax$ and $v_S = bx$ where $a > b$. This captures the idea that the seller needs to raise cash for consumption or investment and the buyer wants to buy an asset to store cash. So they have different valuations.

Equivalently, we could let the seller ask for a price $z = p + \kappa$, pay the transaction tax and keep $p$. Which side of the market has to formally pay the tax does not affect the equilibrium analysis (the economic tax incidence). Importantly, our results do not qualitatively depend on whether the transaction tax applies as a per-unit tax or in percentage of the price paid; see also the remarks in the proofs of Lemma 3 and Proposition 3.

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and the outside option of the buyer is normalized to zero, i.e.
\[ \bar{u}_b := E_u[u_b(x, p, \tau, \kappa, 0)] = 0 \]

We briefly provide a motivation for the main assumptions of the model which is supposed to capture trade in decentralized fixed income markets or interbank funding markets. (i) There are gains from trade, as liquidity management is the main purpose of trade in funding markets. (ii) Both traders have symmetric information ex ante. Before the financial crisis, asymmetric information was not considered as an issue among participants in funding markets (Bank of Canada 2012; Deutsche Bank 2012; McKinsey 2013). Dang, Gorton and Holmstrom (2015a) actually argue that funding markets can only function if agents maintain symmetric information. (iii) Some but not all traders can produce information about the payoff of the asset. Large banks and hedge funds are more sophisticated and capable to produce information than pension funds, insurance companies and corporate cash managers. (iv) For tractability, we assume that only the responder can acquire information. Section 5 analyzes a signaling game in which the proposer can also acquire information.

3. **EQUILIBRIUM ANALYSIS**

The analysis proceeds in two steps. First, we consider the responder’s incentives to acquire information and her best reply given \((p, \tau, \kappa)\). Second, we derive the equilibrium price chosen by the proposer. In the next section we use these results to explicitly analyze the comparative statics effects of a profit tax and transaction tax on the responder’s incentives to acquire information, and the consequences for the equilibrium price and trade.

3.1. **Incentives for information acquisition**

Given the tax rates \(\tau\) and \(\kappa\) and observing a price \(p\) chosen by the proposer, the responder has three options. She can decide not to trade (choose his outside option), she can trade at price \(p\) without information acquisition, or she can acquire information and decide whether to trade conditional on the information received. The responder’s “value of information” depends on the alternative option she considers to choose.
**Definition 1 (Value of information)**

(i) \( q^*(x, p, \tau, \kappa) \) is defined such that

\[
q^*(x, p, \tau, \kappa) = \begin{cases} 
1 & \text{if } u_R(x, p, \tau, \kappa, 1) \geq u_R(x, p, \tau, \kappa, 0) \\
0 & \text{otherwise}
\end{cases}
\]

(ii) \( V_I(p, \tau, \kappa) \) is defined as

\[
V_I(p, \tau, \kappa) = E_x[u_R(x, p, \tau, \kappa, q^*(x, p, \tau, \kappa))] - E_x[u_R(x, p, \tau, \kappa, 1)].
\]

(iii) \( V_{II}(p, \tau, \kappa) \) is defined as

\[
V_{II}(p, \tau, \kappa) = E_x[u_R(x, p, \tau, \kappa, q^*(x, p, \tau, \kappa))] - E_x[u_R(x, p, \tau, \kappa, 0)].
\]

The function \( q^* \) in Definition 1(i) describes the *optimal decision rule* according to which an informed responder trades: She chooses \( q = 1 \) if and only if her utility from trading is larger than his utility from not trading, knowing the true payoff \( x \). Second, \( V_I \) is defined as the responder’s expected utility conditional on knowing the true payoff \( x \) of the asset (and trading according to \( q^* \)), minus her expected utility if she trades with probability one. Hence, \( V_I \) is the responder’s *value of information* when deciding between information acquisition and trading without information acquisition (\( q = 1 \)). Third, \( V_{II} \) is defined as the responder’s expected utility conditional on knowing the true payoff \( x \) minus her expected utility if she does not trade being uninformed. In other words, \( V_{II} \) is the responder’s *value of information* when deciding between information acquisition and being uninformed and not trading (\( q = 0 \)).

Figure 1 illustrates the value of information of the seller and the buyer and highlights the effect of taxation on \( V_I \) and \( V_{II} \) which are useful for the subsequent results. (Appendix A.1 contains formal proofs of the comparative statics effects.)

Consider first the case where the buyer is the responder (Figure 1a). If the buyer knows the true payoff \( x \), the buyer only trades in high states \( x \geq p+\kappa \). Hence, compared to the option of trading with probability one, the value of information \( V_I \) is equal to the expected value of avoiding the loss in states \( x < p+\kappa \). It follows directly that a tax that applies to positive realized profits does not affect \( V_I \). However, a transaction tax \( \kappa \) that increases the (tax-inclusive) price that the buyer has to pay causes \( V_I \) to become larger. Compared to the option of not trading at all, the buyer’s value of information \( V_{II} \) is equal to the expected gains from trade in states \( x \geq p+\kappa \). These gains are reduced by profit taxation; in Figure 1a, \( V_{II} \) becomes

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6. Dang, Gorton and Holmstrom (2015a,b) introduce the terminology “information sensitivity” for the value of information in an optimal security design setting but without taxation. So \( V_I \) and \( V_{II} \) in Definition 1 generalize Lemma 1 in Dang, Gorton and Holmstrom (2015a) to the case where the value of information includes transaction and profit taxes.

7. In Section 4.4 we demonstrate that the subsequent results are reinforced if we include the possibility of a tax treatment of losses.
smaller the larger $\tau$. Moreover, $V_{II}$ is reduced by a transaction tax that increases the tax-inclusive price $p+\kappa$, as an informed buyer trades less often.

**Figure 1:** Effect of profit tax $\tau$ and transaction tax $\kappa$ on the value of information $V_I$ and $V_{II}$.

(a) Buyer is responder

(b) Seller is responder

Note: $v_R(x) = x$; example for $x_L = 0$ and $p_0 = 0$.

If the seller as the responder knows the true payoff $x$, the seller only sells in states $x \leq p$. Therefore, for the seller as the responder, $V_I$ is equal to the expected value of keeping the asset in good states $x > p$ (Figure 1b); $V_I$ becomes smaller if a tax applies to the corresponding profits. Similarly, a profit tax also reduces the seller’s value of information $V_{II}$, which is the profit an informed seller makes by selling in states $x < p$, compared to not participating at all. Since by assumption the transaction tax $\kappa$ is levied on the buyer, it does not affect the seller’s value of information $V_I$ or $V_{II}$ (not yet taking into account reactions of the equilibrium price).

The properties of $V_I$ and $V_{II}$ can be used to determine the best reply of the responder. Facing a price $p$, the optimal decisions on information production and trading can directly be characterized as a function of the information cost $\gamma$. Rather adding an infinitesimally small change in the price to break the indifference of the responder, we assume that (a) if the responder is indifferent between trading and not trading, she decides to trade and (b) if the responder is indifferent between information acquisition and no information acquisition, she does not acquire information.\(^8\)

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\(^8\) This tie-breaking rule is a common assumption in games with continuous strategies so as to ensure the existence of an equilibrium.
**Lemma 1 (Best response of responder)**

Let \((p, \tau, \kappa)\) be given.

(i) If \(V_I \leq \min\{\gamma, V_H\}\), the responder trades without information acquisition.

(ii) If \(\gamma < V_I\) and \(\gamma \leq V_H\), the responder acquires information and trades according to \(q^*(x,p)\).

(iii) If \(V_H < \min\{\gamma, V_I\}\), the responder does not acquire information and does not trade.

Lemma 1 covers all possible constellations. The responder acquires information if and only if both \(V_I\) and \(V_H\) are larger than the cost of information \(\gamma\). Otherwise, the responder does not acquire information; the comparison of \(V_I\) and \(V_H\) reveals whether or not an uninformed responder prefers to trade. An uninformed responder does not trade if \(V_I > V_H\) (which, by Definition 1, is equivalent to \(E_s[u_R(x,p,\tau,\kappa,0)] < E_s[u_R(x,p,\tau,\kappa,0)]\)).

### 3.2. Equilibrium price setting

Taking into account the responder’s best reply, there are three (types of) candidate equilibrium prices that the proposer may choose.

**Definition 2 (Candidate equilibrium prices)**

(i) \(\bar{p}\) is defined such that \(V_I(\bar{p}) = V_H(\bar{p})\).

(ii) \(p_I\) is defined such that \(V_I(p_I, \tau, \kappa) = \gamma\).

(iii) \(p_H\) is defined as \(p_H = \arg \max_{\gamma} E_s[u_R(x,p,\tau,\kappa,q^*(x,p,\tau,\kappa))]\) s.t. \(V_H(p_H, \tau, \kappa) \geq \gamma\).

The price \(\bar{p}\) makes the responder exactly indifferent between trading with probability one and choosing his outside option \(u_R\) (no trade, no information acquisition).\(^9\) The price \(p_I\) is defined such that at \(p_I\) the responder is indifferent between acquiring information and trading according to \(q^*\) on the one hand and not producing information and trading with probability one on the other hand.\(^10\) It can be interpreted as a “bribe” price such that the responder gets some rents and does not acquire information. Finally, \(p_H\) is the price that maximizes the

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\(^9\) By Definition 1(ii)-(iii), this is equivalent to \(E_s[u_R(x,\bar{p},\tau,\kappa,1)] = E_s[u_R(x,\bar{p},\tau,\kappa,0)]\).

\(^10\) As shown in Lemma A.1, \(V_I\) is strictly monotone in \(p\) for prices between \(x_L\) and \(x_H\). For sufficiently low \(\gamma\), \(p_I\) is uniquely defined. If \(\gamma\) is high and the seller is the responder, then \(V_I(p) < \gamma\) for all \(p \geq 0\), but in this case \(p_I\) will never be relevant for the equilibrium characterization. To keep the definitions simple, we omit this case in Definition 2(ii).
proposer’s expected utility in case the responder acquires information and trades according to 
$q^\ast$.\(^{11}\) $p_{II}$ is the price that a monopolistic proposer offers when he faces an informed responder. Here, $p_{II}$ also takes into account the responder’s participation constraint such that the responder’s expected utility from producing information is as large as her reservation utility $\bar{u}_r$ (i.e., $V_U(p_{II}, \tau, \kappa) \geq \gamma$).

If the proposer’s gains form trade are sufficiently small, he will not trade with an informed responder but rather choose his outside option $\bar{u}_p$. This is the case, for instance, if $v_B(x)$ is close to $v_R(x)$. In the following, we will concentrate on situations where the proposer’s incentives to trade are sufficiently strong or, in other words, $\bar{u}_p$ is sufficiently low. Technically, we assume that $E_x[u_p(x, p_{II}, \tau, \kappa, q^\ast(x, p_{II}, \tau, \kappa)) \geq \bar{u}_p$, i.e., the proposer is willing to trade with an (endogenously) informed responder.\(^{12}\)

**Definition 3 (Critical information cost)**

$\gamma$ is defined such that $E_x[u_p(x, p_I, \tau, \kappa, 1)] = E_x[u_p(x, p_{II}, \tau, \kappa, q^\ast(x, p_{II}, \tau, \kappa))].$

In other words, $\gamma$ is defined as the information cost such that the proposer is indifferent between offering the “bribe” price $p_I$ where the responder trades ($q=1$) without information acquisition and the price $p_{II}$ where the responder acquires information and trades optimally according to $q^\ast$, given her information. Under the first strategy, the bribe is larger the smaller the information cost. Under the second strategy, trade only occurs with positive probability but the proposer only needs to compensate the responder for costly information acquisition. So if $\gamma$ is small, giving in to adverse selection can dominate a bribe. Which strategy is the best response of the proposer depends on his utility derived from trade and $F(x)$. There are cases where avoiding information acquisition always dominates inducing information acquisition. This could arise if the buyer’s utility from owning the asset is sufficiently high (e.g. $v_B(x)=Mx$ with $M$ large) then $\gamma > 0$ does not exist. His best response is to propose a

\(^{11}\) For arbitrary functions $F$ as well as $v_S$ and $v_B$, $p_{II}$ is not necessarily unique. When considering the effects of taxation, we neglect this possibility of multiple $p_{II}$ as optimal solutions (where all yield the same expected utility to the proposer), which could be ruled out by some further assumptions on $F$.

\(^{12}\) Note, $E_x[u_p(.)]$ is the expected utility of the proposer when he offers a price such that the responder acquires information and the informed responder trades optimally given his information. For example, if the buyer is the responder he only buys when $x \geq p_{II}$. So on average, the seller receives less than the expected payoff of the asset conditional on trade.
sufficiently high price $p$ (where $V_I(p) = \gamma$) such that the seller accepts with probability one and without information acquisition. We focus on the more interesting cases where $\gamma > 0$ and there are three possible types of equilibrium outcomes.

**Proposition 1**

Suppose that $E\left[u_p(x, p_{II}, \tau, \kappa, q^{*}(x, p_{II}, \tau, \kappa))\right] \geq \pi_p$ and $\gamma > 0$.

(i) If $\gamma \geq V_I(\overline{p}, \tau, \kappa)$, then $p^{*} = \overline{p}$ and the responder trades without information acquisition.

(ii) If $\gamma \leq \gamma < V_I(\overline{p}, \tau, \kappa)$, then $p^{*} = p_I$ and the responder trades without information acquisition.

(iii) If $\gamma < \gamma$, then $p^{*} = p_{II}$ and the responder acquires information and trades according to $q^{*}$.

Proposition 1 characterizes the equilibrium properties which hold for the buyer as well as the seller being the proposer. The result on the equilibrium price $p^{*}$ is intuitive. If the cost of information is high, information acquisition is irrelevant. In this case, the proposer offers the price $\overline{p}$ that gives the responder his outside option, i.e. no rents. Since trade occurs with probability one, this is the optimal price (Proposition 1(i)). Note, in the absence of taxation, for instance, this price would be equal to the responder’s expected valuation $E[v_R(x)]$ of the asset.

For intermediate cost of information, the responder would react to such a price by acquiring information and then trading only when a gain can be realized. The proposer, however, is better off by adjusting the price such that the responder has no incentives to acquire information (Proposition 1(ii)). Technically, the proposer chooses a price $p_I$ such that the value of information is $V_I(p_I, \tau, \kappa) = \gamma$. Here, even if there is no information acquisition in equilibrium, the responder gets an information rent (his equilibrium utility is higher than $\overline{u}_R$).

The lower the cost of information, the more costly it becomes for the proposer to prevent information acquisition (the higher is the share of the surplus he has to offer to the responder). So there might exist a threshold $\gamma$ below which the nature of the equilibrium changes and the proposer chooses a price that induces the responder to acquire information (Proposition 1(iii)). This price $p_{II}$, however, has to take into account that the responder is being compensated for

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13 The buyer as a proposer will increase the price while the seller as a proposer will decrease the price so as to prevent information production by the responder.
the cost of information in that his expected surplus from trade covers the cost of information production (i.e. \( V_{II} \geq \gamma \)). While for very low cost of information this condition will always be fulfilled, it can be binding if \( \gamma \) is sufficiently close to \( \gamma \). In the former case, the responder gets a positive net surplus \( (\gamma \kappa \tau > 0) \); in the latter case, the responder’s equilibrium surplus from trade net of information cost is zero \( (\gamma \kappa \tau = 0) \), i.e., his expected utility is equal to \( \bar{u}_R \). The results of Proposition 1 are summarized in Figure 2 which hold both for the case where the buyer and where the seller makes the offer.

Figure 2: Equilibrium price setting and information acquisition.

It is worth noting that the equilibrium payoff of the responder can be non-monotonic in the information cost. For low information costs, she obtains some rents in the equilibrium with information acquisition. If the information cost increases, the responder’s rents in the equilibrium with information acquisition are reduced to zero. If information cost is in a middle range, the responder gets rents again since she is “bribed” so as to trade without information acquisition. And if the information cost is high, the proposer is not concerned about information acquisition and the responder gets no rents.\(^{14}\)

We use the concept of “information sensitivity” in Dang, Gorton and Holmstrom (DGH 2015a,b) to characterize equilibrium outcomes, but the results in Proposition 1 are different from their results. The setup in DGH (2015a,b) is more general in the sense that agents are not obliged to trade an asset of fixed size but can used it as a collateral to back the payoff of security that the agents design to trade. DGH (2015b) show that if the seller can acquire information and the uninformed buyer proposes a price and a security to buy, there is never information acquisition in equilibrium irrespective of the magnitude of gains from trade and

\(^{14}\) Proposition 1 extends some results in Dang (2008) to the cases where (i) the payoff \( x \) of the asset is continuous, (ii) has arbitrary distribution \( F(x) \), and (iii) there is taxation.
even if information cost is vanishingly small. DGH (2015a) show that if the buyer can acquire information and the uninformed seller proposes a price and a security to sell, there might be information acquisition in equilibrium when information cost is small but the responder (buyer) never obtains any rents. Both of these equilibrium outcomes are not present in our model because agents trade an asset of fixed size.

4. THE EFFECTS OF TAXATION ON EQUILIBRIUM PRICE AND TRADE

The equilibrium analysis in the previous section has taxation implicitly captured in the utility functions and there is no need to distinguish between whether the buyer or seller is the proposer. Now we explicitly analyze the effects of a marginal increase in the profit tax and in the transaction tax, respectively, in two steps: First, we derive the effects of each of the tax instruments on the equilibrium candidate prices $\tilde{p}$, $p_I$ and $p_{II}$ (taking into account the responder’s best reply). Then, we show how a tax increase affects the proposer’s choice between these candidate prices and in this way affects equilibrium information acquisition.

For the intermediate step of the effect on the candidate equilibrium prices we need to distinguish who is the proposer and responder as the comparative statics results are different for the cases if the buyer is the proposer or the seller is the proposer. Yet the (final) equilibrium implications of the two types of tax instruments do not depend on who is the proposer.

4.1. The effect of a profit tax

We first consider the price effects of a profit tax increase.

Lemma 2 (Comparative statics of equilibrium prices)

Let $\tilde{p}$, $p_I$ and $p_{II}$ be defined as in Definition 2 and consider the effect of a profit tax $\tau$.

(i) If the seller is the proposer, then (a) $\partial \tilde{p}/\partial \tau < 0$, (b) $\partial p_I/\partial \tau = 0$, and (c) $\partial p_{II}/\partial \tau \leq 0$ (with strict inequality if and only if $V_{II}(p_{II}) = \gamma$).

(ii) If the buyer is the proposer, then (a) $\partial \tilde{p}/\partial \tau \leq 0$, (b) $\partial p_I/\partial \tau \leq 0$ (with strict inequality if $x_L < p_0 < x_{II}$), and (c) $\partial p_{II}/\partial \tau \geq 0$ (with strict inequality if and only if $V_I(p_{II}) = \gamma$).

Although not immediately obvious, the economic mechanisms behind Lemma 2 are intuitive. First suppose that the cost of information is high (i.e., case (a)) and the proposer offers a price
\[ \bar{p} \] such that the responder trades without information acquisition and obtains no rents, that is, expected gains and losses are equalized (i.e., \( V_I(\bar{p}, \tau) = V_{II}(\bar{p}, \tau) \)). If the buyer is the responder, then the gains, \( V_{II}(\bar{p}, \tau) \), become smaller the higher the profit tax while the expected loss \( V_I^B \) is independent of \( \tau \). Thus the seller must reduce the price in order to induce the buyer to participate.

Now suppose the seller is the responder. When selling at \( p \) the seller’s utility is \( p - \tau \cdot \max[p - p_0, 0] \). If the seller does not sell, her expected utility is \( E[x] - \tau \int \max[x - p_0, 0] dF(x) \). The seller is indifferent if the two strategies yield the same expected utility. So the buyer proposes \( \bar{p} = E[x] - \tau \int \max[x - p_0, 0] dF(x) + \tau \max[\bar{p} - p_0, 0] \).

The maximum price the buyer needs to offer is \( E[x] \). The second term is the expected tax payment when the seller keeps the asset. Therefore, the buyer can reduce the price by this amount. The third term is the tax payment if the seller sells above \( p_0 \). The buyer needs to compensate the seller for that tax payment. This amount is smaller than the tax payment of not selling since \( \bar{p} \leq E[x] \). Intuitively, there is a tax disadvantage of not selling. Therefore, \( d\bar{p} / d\tau < 0 \) if \( x_L < p_0 < x_H \). Otherwise, \( d\bar{p} / d\tau = 0 \). Note, if \( p_0 \leq x_L \), at \( \bar{p} = E[x] \), the seller pays the same tax with trade and without trade. So the buyer proposes \( \bar{p} = E[x] \) for any \( \tau \).

If \( p_0 \geq x_H \) there is no tax payment at all.

For intermediate costs of information, the proposer chooses a price \( p_I \) which just prevents information acquisition of the responder by giving her some rents, i.e. \( V_I(p_I, \tau) = \gamma \). If the buyer is the responder, information costs equals \( V_I^B \) which is her expected loss (see Figure 1(a)). The expected loss of the buyer is independent of profit tax \( \tau \). Therefore, the seller cannot adjust \( p_I \). In contrast, if the buyer is the proposer, the seller’s value of information (realizing a gain if the asset’s payoff is high) is decreasing in \( \tau \), i.e. \( dV_{II}^S(p_I, \tau) / d\tau < 0 \). Note, keeping the asset in high states is less attractive because of the tax on capital gains. See Figure 1(b). Thus, if the profit tax is increased, the buyer can lower \( p_I \) and still prevent information acquisition of the seller. Formally, \( \tau < \tau_{new} \), \( dV_{II}^S(p_I, \tau) / d\tau < 0 \), and \( V_{II}^S(p_I^{new}, \tau_{new}) = \gamma \) imply that \( p_I^{new} < p_I \).

Finally, if the cost of information is low, then the responder acquires information. Her information rent is reduced by a profit tax increase, but her trading decision is not directly affected by an increase in \( \tau \). Thus, the proposer’s optimal price \( p_{II} \) does not change unless the
responder’s participation constraint is binding (that is, $V_{II} = \gamma$). In the latter case, the proposer must adjust the price $p_{II}$ in order to compensate the responder for information cost in the light of a higher profit tax. In such a case the seller as the proposer lowers the price. An informed buyer trades more often. On the other hand, the buyer as the proposer increases the price. An informed seller trades more often.

If $\bar{p}$ or $p_I$ is played in equilibrium profit taxation only shifts the gains from trade among the buyer, seller and government but does not affect the probability of efficient trade and there is no costly information acquisition. However, taxation of profits has welfare implications if $p_{II}$ is played in equilibrium. The next proposition identifies two effects and show how a tax on profit increases welfare.

**Proposition 2**

Suppose $\gamma > 0$. An increase in the profit tax $\tau$

(i) increases the probability of trade in an equilibrium with information acquisition ($\gamma < \underline{\gamma}$).

(ii) and lowers the threshold $\underline{\gamma}$ below which there is information acquisition in equilibrium.

Proposition 2 identifies a direct and an indirect welfare effect of a profit tax increase. First, in an equilibrium with information acquisition (that is, for $\gamma < \underline{\gamma}$), profit taxation increases the probability of trade by reducing the responder’s information rent, which must be compensated by a more favorable price for the responder: A more favorable price means higher probability of trade (Proposition 2(i)). Second, as the indirect effect, a profit tax increase affects the proposer’s choice between the equilibrium candidate prices. Since taxation of profits (weakly) reduces the incentives to acquire information (strictly for the seller), this makes it relatively more attractive for the proposer to prevent information production by offering a price $p_I$ (Proposition 2(ii)).

Proposition 2 holds independently of the identity of the proposer and the responder. While profit taxation can affect the equilibrium price when information is endogenous, a profit tax increase has no effect on the equilibrium probability of trade if asymmetric information is exogenous.
Corollary 1

Suppose that the responder is informed (γ = 0). An increase in the profit tax τ does not affect the equilibrium probability of trade.

Since the case where the responder is informed can be interpreted as γ = 0, the proposer’s choice p_{II} is independent of τ.\(^{15}\) Hence, although it reduces the responder’s information rent, a marginal increase in τ has no effect on the equilibrium probability of trade. Note, the informed buyer trades in states x where x ≥ p and makes a profit of τ(x-p). Therefore, a profit tax does not affect the set of states with trade. Similarly, an informed seller trades if p ≥ x.

4.2. The effect of a transaction tax

Like in the case of profit taxation, if \(\bar{p}\) or p_{I} is played in equilibrium a transaction tax only redistributes the gains from trade among the buyer, seller and government but does not affect the probability of efficient trade and there is no information acquisition. A transaction tax has welfare implications if p_{II} is played in equilibrium. The next Lemma characterizes the effects of a marginal increase in the transaction tax κ on the three equilibrium candidate prices.\(^{16}\)

Lemma 3 (Comparative statics of equilibrium prices)

Let \(\bar{p}\), p_{I}, and p_{II} be defined as in Definition 2 and consider the effect of a transaction tax κ.

(i) If the seller is the proposer, then (a) \(\partial(\bar{p} + κ)/\partial κ = 0\), (b) \(\partial(p_{I} + κ)/\partial κ = 0\), and (c) \(\partial(p_{II} + κ)/\partial κ ≥ 0\) (with strict inequality if and only if \(V_{II}(p_{II}) > γ\)).

(ii) If the buyer is the proposer, then (a) \(\partial\bar{p}/\partial κ = 0\), (b) \(\partial p_{I}/\partial κ = 0\), and (c) \(\partial p_{II}/\partial κ ≤ 0\) (with strict inequality if and only if \(V_{II}(p_{II}) > γ\)).

The intuition for Lemma 3 is as follows. The buyer as the responder bases his buying decision on the tax-inclusive price \(p + κ\) while the seller as the responder cares about the net-of-tax price p. If the transaction tax is increased, the relevant prices which make the responder indifferent between trading uninformed and (a) his outside option and (b) information acquisition have to remain unchanged. Hence, the seller as the proposer has to adjust his offer such that the tax-inclusive prices \(\bar{p} + κ\) and \(p_{I} + κ\) remain unchanged, while the buyer as the proposer has to

\(^{15}\) When γ = 0, this result follows from Lemma 1(ii) together with Lemma 2(i)c and (ii)c (where \(V_{II} > γ\)).

\(^{16}\) As for the comparative statics results for the profit tax, we assume that tax-inclusive prices are in some “interior” range (between \(x_{L}\) and \(x_{H}\)) and that p_{II} is unique.
ensure that the net-of-tax prices $\bar{p}$ and $p_I$ remain unchanged. The same argument holds for the price $p_{II}$ whenever the responder’s participation constraint is binding ($V_{II}(p_{II}) = \gamma$).

The most interesting case is a situation where $V_{II}(p_{II}) > \gamma$ and the responder gets a strictly positive rents when trading at $p_{II}$. Here, the proposer is able to shift (part of) the tax increase to the responder by adjusting the price accordingly. This will lead to an increase in the (tax-inclusive) price if the seller makes the offer and to a decrease in the (net-of-tax) price if the buyer makes the offer.

**Proposition 3**

Suppose $\gamma > 0$. An increase in the transaction tax $\kappa$

(i) lowers the probability of trade in an equilibrium with information acquisition ($\gamma < \gamma$)

(ii) and increases the threshold $\gamma$ below which there is information acquisition in equilibrium.

If the cost of information is low and there is information acquisition in equilibrium, an increase in the transaction tax makes trade less attractive. Intuitively, whenever possible, the proposer shifts part of the increased tax burden to the responder although this reduces the probability of trade with an informed responder (Proposition 3(i)). Moreover, an increase in the transaction tax (weakly) increases the incentives to produce information (strictly for the buyer as the responder); in addition, the tax burden is higher in the equilibrium candidate without information acquisition because trade occurs with higher probability. This makes it less attractive for the proposer to offer a price that prevents information acquisition (Proposition 3(ii)). Together, the direct and indirect effects of a transaction tax increase lead to less trade and more information acquisition.

Propositions 2 and 3 imply that the two different types of taxes have exactly the opposite welfare effects in a market with gains from trade. Profit taxation mitigates the (endogenous) lemons problem, whereas transaction taxes make it worse. Since the sum of the welfare of the trading parties and tax revenue is highest if there is trade with probability one and no information acquisition, profit taxation can be welfare-improving, while transaction taxes reduce welfare.\(^{17}\) But the policy implications depend, of course, on the welfare criterion and

\(^{17}\) Due to the effect on the probability of trade, this result still holds if the cost of information is not socially wasteful but only redistributive for welfare purposes.
on whether an increase in the probability of trade is socially desirable (compare also the discussion in Section 6).

4.3. **Discussion of information acquisition of the proposer**

In this section we discuss the effects of taxation on the proposer’s incentives to acquire information before making the price offer. Adding the possibility to acquire information by the proposer requires the analysis of an endogenous signaling game. We consider a framework which is identical to the main model, except for the followings: First, we allow the proposer to learn the asset’s payoff \( x \) at cost \( \gamma_p \) before he makes the price offer; we assume information production of the proposer to be unobservable to the responder and that the proposer cannot credibly reveal any private information.\(^{18}\) Second, for simplicity we ignore taxation of the responder’s profits and the effects of taxation on the responder’s decision to acquire information, which has been considered in the main analysis. Third, we are focusing on the cases where the proposer chooses to avoid information production by the responder. By allowing the proposer to acquire information (or when his information costs become smaller) we analyze the implications of taxation on the proposer’s incentive to acquire information.\(^{19}\) Propositions B1 and B2 in Appendix B show that the resulting effects of taxation on the proposer’s incentive to acquire information and on the efficiency of trade are similar to the main Propositions 2 and 3.

4.4. **Discussion of profit taxation and deductibility of losses**

This section discusses how a tax treatment of losses affects the results in Proposition 2. Suppose that losses are partly deductible for tax purposes, for instance because they can be credited against future gains and/or other current income. This option becomes more valuable in high-tax regimes. Formally, we can model a loss offset by a parameter \( \lambda \in [0,1] \) that determines the share of the loss that is tax-deductible. This is equivalent to a “subsidy” \( \lambda \tau \) per unit of a loss from trading asset \( x \). See Figure 3.

\(^{18}\) If the proposer could credibly reveal his private information, he would prefer to do so: This would allow him to extract the entire surplus by setting a price equal to the responder’s valuation \( v_R(x) \).

\(^{19}\) The other cases can be analyzed analogously. Note, even if both the proposer and responder have very low information costs, in any equilibrium where the proposer acquires information with positive probability the responder will randomize his information acquisition. There is no equilibrium where both players acquire costly information with probability one and trade occurs with probability one. See Dang (2008).
Consider the case of the responder being the buyer who acquires information in order to avoid the loss of buying the asset in low payoff states $x < p$. Here, increases in the profit tax reduce the buyer’s value of information $V_I$ (Figure 3a). As a consequence, charging the price $p_I$ becomes relatively more attractive for the seller. Therefore, with a tax treatment of losses, the effect of profit taxation on the threshold $\gamma$ becomes even stronger in this case. By similar arguments, the statements in Proposition 2 continue to hold for the case where the seller is the responder (compare Figure 3b).

**Figure 3:** Effect of profit taxation on the value of information $V_I$ in case of a loss offset.

(a) Buyer is responder

(b) Seller is responder

Note: $v_R(x) = x$; example for $x_L = 0$ and $0 < p_0 < p$.

5. **CONCLUDING REMARKS**

This paper analyzes the effects of taxation on information acquisition and trade in decentralized markets. We show that taxation has both a direct and indirect effect on equilibrium behaviors and derive the novel result that a profit tax and transaction tax have opposite implications for equilibrium behaviors and outcomes. An increase of a transaction tax increases the incentive to acquire private information. It reduces the probability of trade in equilibrium with information acquisition and adverse selection. Furthermore, as an indirect effect a transaction tax increases the range of information costs, where equilibrium exhibits adverse selection. The exact opposite holds for a tax on profits.

Since information is typically endogenous in financial markets, understanding the equilibrium incentive effects of taxation on information acquisition and bargaining behavior at the trading level is important for policy design. In the context of funding markets, proponents of transaction taxes often refer to “creating appropriate disincentives for transactions that do

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20 Formally, the same steps as in the analysis above (Lemma 2 and Proposition 2) yield $\frac{\partial p_I}{\partial \tau} > 0$ and $\frac{\partial \gamma}{\partial \tau} < 0$. 

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not enhance the efficiency of financial markets thereby complementing regulatory measures to avoid future crises.” (European Commission, 2013, p.2). Our paper, however, shows that a transaction tax can potentially lead to more private information acquisition and increases the problem of asymmetric information.\textsuperscript{21} We show that a profit tax dominates a transaction tax in decentralized markets (such as debt funding markets), in which agents trade for liquidity reasons and private information acquisition is a concern among market participants since it creates endogenous adverse selection.

The policy implications of the two tax instruments depend on whether an increase in the probability of trade (liquidity) is socially desirable and they are diametrically opposed. Trades though individually rational might be socially excessive because e.g. they have implications for financial stability and negative externalities on tax payers. Especially, this phenomenon is controversially discussed in the context of high frequency trading in stock markets, emphasizing distortionary and manipulative effects on equity prices as opposed to liquidity increases and the reduction of bid ask spreads and transaction costs for investors. Thus, parallel questions on the effects of profit taxes versus transaction taxes arise.\textsuperscript{22}

Asymmetric information has been considered a main problem in decentralized debt funding markets in the course of the financial crisis when investors became concerned about complexity and quality of the securities used to trade. In a setting where there are gains from trade and private information acquisition generates endogenous adverse selection, our theoretical analysis suggests that a profit tax dominates a transaction tax. In contrast to a transaction tax, a tax on profits reduces the incentive to acquire information, mitigates endogenous adverse selection and increase liquidity and welfare in equilibrium.

\textsuperscript{21} In the trivial case of a prohibitive high transaction tax, there will be no trade. But this is equivalent to de facto forbidding trade. Similarly, if the profit tax is 100%, the buyer will not buy.

\textsuperscript{22} A further dimension of the problem relates to the choice between different types of information and situations in which information has a social value and agents can learn about the gains from trade. These are interesting questions but beyond the scope of this paper. Our model proposes a tractable setting that might be generalized so as to address further related questions.
APPENDIX A

A.1 Comparative statics of the value of information $V_I$ and $V_{II}$

Consider first the value of information $V_I$.

**Lemma A.1 (Comparative statics of $V_I$)**

(i) Suppose that $p + \kappa > x_L$. If the buyer is the responder, $V_I$ is (a) strictly increasing in the price $p$, (b) independent of the profit tax $\tau$, and (c) strictly increasing in the transaction tax $\kappa$.

(ii) Suppose that $p < x_H$. If the seller is the responder, $V_I$ is (a) strictly decreasing in the price $p$, (b) strictly decreasing in the profit tax $\tau$, and (c) independent of the transaction tax $\kappa$.

**Proof:** This result follows directly from the definition of $V_I$. Consider first part (i). The buyer pays a profit tax if and only if he buys and the payoff of the asset is above the price paid. Hence, for the buyer,

$$V_I(p, \tau, \kappa) = \int_{p+\kappa}^{x_L} (1 - \tau)(x - (p + \kappa))dF(x) - \int_{p+\kappa}^{x_H} (1 - \tau)(x - (p + \kappa))dF(x)$$

which is strictly increasing in $p$ and in $\kappa$ but independent of $\tau$.

For part (ii), the seller pays a profit tax if he does not sell and the return is above the ‘book value’ $p_0$ or if he sells at price $p$ above $p_0$. Thus, for the seller as responder we get

$$V_I(p, \tau, \kappa) = \int_{0}^{p} ((p + \kappa) - x)dF(x)$$

which is strictly increasing in $p$ and independent of $\kappa$. Moreover,

$$\frac{\partial V_I}{\partial \tau} = \int_{0}^{p} (\max\{p - p_0, 0\} - \max\{x - p_0, 0\})dF(x) < \int_{0}^{p} (\max\{x - p_0, 0\})dF(x) = 0.$$ 

Thus, $V_I$ is strictly decreasing in $\tau$ if the seller is the responder. ■

Now we turn to the value of information $V_{II}$.

**Lemma A.2 (Comparative statics of $V_{II}$)**

(i) Suppose that $p + \kappa < x_H$. If the buyer is the responder, $V_{II}$ is (a) strictly decreasing in the price $p$, (b) strictly decreasing in the profit tax $\tau$, and (c) strictly decreasing in the transaction tax $\kappa$. 


(ii) If the seller is the responder, $V_{II}$ is (a) strictly increasing in the price $p$, (b) decreasing in the profit tax $\tau$ (strictly decreasing only if $p_0 < p$), and (c) independent of the transaction tax $\kappa$.

Proof: Part (i) follows directly from the fact that for the buyer as responder,

$$V_{II}(p, \tau, \kappa) = \int_{p+x}^{\infty} (1-\tau)(x-(p+\kappa))dF(x).$$

For part (ii), note that for the seller as responder

$$V_{II}(p, \tau, \kappa) = \int_{x}^{\infty} (p-x-(\tau \max\{p-p_0,0\} - \tau \max\{x-p_0,0\}))dF(x),$$

which is independent of $\kappa$ and strictly increasing in $p$ (due to $\tau < 1$). Finally,

$$\frac{\partial V_{II}}{\partial \tau} = \int_{x}^{\infty} (\max\{x-p_0,0\} - \max\{p-p_0,0\})dF(x) \leq \int_{x}^{\infty} (\max\{x-p_0,0\} - \max\{x-p_0,0\})dF(x) = 0,$$

therefore $V_{II}$ decreases in $\tau$ (strictly if and only if $p_0 < p$; otherwise, $V_{II}$ is independent of $\tau$). ■

A.2 Proof of Lemma 1

Part (i): Since $V_I \leq V_{II}$ is equivalent to $E[I_{R}(x, p, \tau, \kappa, 0)] \leq E[I_{R}(x, p, \tau, \kappa, 1)]$, the responder prefers to trade uninformed over no trade. Moreover, $V_I \leq \gamma$ implies that the responder prefers to trade uninformed over information acquisition.

Part (ii): With $V_I > \gamma$, the responder prefers information acquisition over trading uninformed. Moreover, the responder’s expected gain from information acquisition compared to his outside option is $V_{II} - \gamma \geq 0$; hence, he can cover the information cost.

Part (iii): Since $V_{II} < V_I$ is equivalent to $E[I_{R}(x, p, \tau, \kappa, 0)] > E[I_{R}(x, p, \tau, \kappa, 1)]$, an uninformed responder does not trade. Moreover, since $V_{II} < \gamma$, the gain from information acquisition is smaller than the cost, and the responder’s optimal choice is his outside option (no information acquisition and no trade), irrespectively of whether $V_I > \gamma$ or not.

A.3 Proof of Proposition 1

At $\gamma = \gamma$, the proposer is indifferent between inducing the responder to trade with probability one (without information acquisition) on one hand and information acquisition and trade according to $q^*$ on the other hand.

Part (i): Suppose that $\gamma \geq V_I(\bar{p}, \tau, \kappa)$. With Definition 2(i) and the definitions of $V_I$ and $V_{II}$, this implies that $V_I(\bar{p}, \tau, \kappa) = V_{II}(\bar{p}, \tau, \kappa) \leq \gamma$; hence, by Lemma 1(i), the responder trades without information acquisition. In fact, the responder’s expected utility is the same as if he chooses
not to participate; therefore, there is no other price that the proposer strictly prefers to \( \bar{p} \) and where the responder still trades with probability one. Moreover, the proposer also strictly prefers \( \bar{p} \) to \( p_H \) since, at \( p_H \), there is trade with lower probability and, in addition, the responder has to be compensated for the cost of information (he must still get at least what he gets when choosing not to participate). This shows part (i).

Part (ii): Note first that \( E_1[u_p(p, \eta, \gamma)] \) is continuous and increasing in \( \gamma \). Continuity in \( \gamma \) follows from continuity of \( u_p(x, \eta, \gamma, 1) \) in \( p \) and the definition of \( p_I \). For monotonicity in \( \gamma \), notice that \( p_I = \arg \max_p E_1[u_p(x, \eta, \gamma, 1)] \) s.t. \( V_I(p, \tau, \kappa) \leq \gamma \) and that, at the optimal price \( p_I \), the constraint \( V_I \leq \gamma \) must be binding. Hence, if \( p_I \) is charged and trade occurs with probability one, then an increase in the cost of information makes the proposer strictly better off. (Intuitively, the constraint \( V_I \leq \gamma \) is relaxed.)

By part (i), at \( \gamma = V_I(\bar{p}, \tau, \kappa) \) the proposer strictly prefers an offer \( \bar{p} = p_I \) over an offer \( p_H \). By continuity and monotonicity of \( E_1[u_p(x, \eta, \gamma, 1)] \), there exists \( \delta > 0 \) such that the proposer strictly prefers \( p_I \) over \( p_H \) for all \( \gamma \in (V_I(\bar{p}, \tau, \kappa) - \delta, V_I(\bar{p}, \tau, \kappa)] \). Finally, if \( \gamma < V_I(\bar{p}, \tau, \kappa) \) and the proposer offers \( \bar{p} \), then the responder will acquire information; thus, by definition of \( p_H \), the proposer (weakly) prefers \( p_H \) over \( \bar{p} \). Altogether this shows part (ii).

Part (iii): First of all, if \( \gamma \) approaches zero, then the proposer cannot avoid information acquisition of the responder, and therefore the proposer’s optimal choice will be \( p_H \). (This requires, of course, that the proposer is willing to trade with an informed responder, i.e., it requires that the value of the proposer’s outside option is sufficiently low such that \( E_1[u_p(x, \eta, \gamma, 1)] \geq \bar{u}_p \).) Second, \( E_1[u_p(x, \eta, \gamma, 1)] \) is (weakly) decreasing in \( \gamma \): If \( p_H \) is the unconstrained optimum, i.e. \( V_H(p_H, \tau, \kappa) < \gamma \), then a marginal increase in \( \gamma \) does not affect \( p_H \) (because then the proposer’s utility does not depend on \( \gamma \)). If, however, \( V_H(p_H, \tau, \kappa) = \gamma \), an increase in \( \gamma \) makes the proposer worse off. (Intuitively, the proposer must leave a higher share in the surplus to the responder in order to compensate him for the higher cost of information and to ensure that the responder does not choose his outside option \( \bar{u}_x \).) Therefore, the monotonicity properties of \( E_1[u_p(x, \eta, \gamma, 1)] \) and \( E_1[u_p(x, \eta, \gamma, 1)] \) imply there is a threshold \( \gamma \) such that the proposer offers \( p_H \) if and only if \( \gamma < \gamma \).
A.4 Proof of Lemma 2

Part (i): Consider first the effect on $\overline{p}$. By Definition 2(i), $V_i(\overline{p}, \tau, \kappa) = V_u(p, \tau, \kappa)$. If the buyer is the responder, $V_i$ is independent of $\tau$ (Lemma A.1(i)). Since $V_u$ is strictly decreasing in $\tau$ and in $p$ (Lemma A.2(i)), an increase in $\tau$ must be compensated by a decrease in $p$; thus, $\partial p / \partial \tau < 0$. By a similar argument, since $V_i$ is independent of $\tau$ and $p_i$ is defined such that $V_i = \gamma$ (Definition 2(ii)), we get $\partial p_i / \partial \tau = 0$.

Now consider the effect on $p_H$. Suppose first that the buyer’s participation constraint is binding: $V_H(p_H, \tau, \kappa) = \gamma$. Since $V_H$ is strictly decreasing in $\tau$, the seller must strictly lower the price $p_H$ if $\tau$ is increased; otherwise, $V_H < \gamma$ and the buyer strictly prefers his outside option $p_e = 0$ to information acquisition (Lemma 1(iii)). If the buyer’s participation constraint does not bind ($V_H(p_H, \tau, \kappa) > \gamma$), a marginal increase in the profit tax $\tau$ has no effect on the price $p_H$; it does not affect the buyer’s buying decision but only reduces the buyer’s profit that results from his informational advantage. Altogether, this shows part (i).

Part (ii): Consider first the effect on $\overline{p}$ and suppose that $p_0 \leq x_L$. If the seller does not trade, she always pays a tax and her expected utility is $E[x] - \tau \cdot (E[x] - p_0)$. If she sells her utility is $p - \tau(p - p_0)$. Thus the buyer proposes $\overline{p} = E[x]$ and $d\overline{p} / d\tau = 0$. For $p_0 > x_H$, there is no tax to be paid. The buyer offers $\overline{p} = E[x]$ and $d\overline{p} / d\tau = 0$. For $x_L < p_0 < x_H$, the seller compares $E[x] - \tau \left( \int_{p_0}^{x_H} (x - p_0) dF(x) \right)$ with $p - \tau \cdot \max[p - p_0, 0]$. So $\overline{p} = E[x] - \tau \left( \int_{p_0}^{x_H} (x - p_0) dF(x) - (\overline{p} - p_0) \right)$. Since $\overline{p} \leq E[x]$ (which is the maximum price the buyer offers if $\tau = 0$) the first term in the bracket is larger than the second term and thus $d\overline{p} / d\tau < 0$.

Now turn to $p_I$. Since $V_i$ is strictly decreasing in $p$ and strictly decreasing in $\tau$ (Lemma A.1), we have $\partial p_I / \partial \tau < 0$. Similarly, since $V_u$ is strictly decreasing in $\tau$ and strictly increasing in $p$, we must have $\partial p_I / \partial \tau > 0$ if $V_u(p_H, \tau, \kappa) = \gamma$ such that the seller’s participation constraint binds. Otherwise, if $V_u(p_H, \tau, \kappa) > \gamma$, then profit taxation reduces the seller’s information rents but does not affect the price $p_H$, just as in the case where the buyer is the responder.

A.5 Proof of Proposition 2

Part (i) follows directly from Lemma 2. If the buyer is the responder and the price $p_H$ decreases, then the probability of trade is increased (as an informed buyer trades if and only if $x > p$). If the seller is the responder and the price $p_H$ increases, then again the probability of
trade is increased (as an informed seller trades if and only if \( x < p \)). In both cases, an increase in the profit tax strictly increases the probability of trade if and only if \( V_H(p_H, \tau, \kappa) = \gamma \).

For part (ii), recall that, at \( \gamma = \gamma \), we have \( E_s[u_s(x, p_H, \tau, \kappa, 1)] = E_s[u_s(x, p_H, \tau, \kappa, q^*)] \). Suppose first that the seller makes the offer. By Lemma 2(i), \( \partial p_H / \partial \tau = 0 \) and \( \partial p_H / \partial \tau \leq 0 \). Therefore, the seller’s utility from charging \( p_I \) is not affected by an increase in \( \tau \), but his expected utility in the equilibrium candidate with information acquisition is (weakly) reduced because the price \( p_H \) decreases. (Since, in the equilibrium candidate with information acquisition, the seller could have charged a lower price already before the tax increase, lowering the price \( p_H \) must make him (weakly) worse off.) Therefore, at \( \gamma = \gamma \), the seller now (weakly) prefers \( p_I \) over \( p_H \), which shifts the threshold \( \gamma \) to the left. If \( \partial p_H / \partial \tau = 0 \), then \( \partial \gamma / \partial \tau = 0 \), and if \( \partial p_H / \partial \tau < 0 \), then \( \partial \gamma / \partial \tau < 0 \).

Now suppose that the buyer makes the offer. By Lemma 2(ii), a marginal increase in \( \tau \) leads to a reduction in \( p_I \), which makes the buyer strictly better off (he still gets the asset with probability one but at a lower price). Moreover, a marginal increase in \( \tau \) (weakly) increases \( p_H \), which makes the buyer (weakly) worse off: He gets the asset with a higher probability but pays a higher price for it. Since the buyer could have offered this higher price already before the increase in \( \tau \), the price increase must reduce his profit. (For prices \( p \) above \( p_H \), an informed seller’s participation constraint \( E_s[u_s(x, p, \tau, \kappa, q^*)] - \gamma \geq \bar{w}_s \) is still fulfilled.) The two effects of an increase in \( \tau \) on \( p_I \) and \( p_H \) directly imply that, at \( \gamma = \gamma \), the buyer now strictly prefers \( p_I \) over \( p_H \). Therefore, \( \gamma \) shifts to the left if \( \tau \) is increased: \( \partial \gamma / \partial \tau < 0 \).

### A.6 Proof of Lemma 3

Part (i): Since, by definition, the sales tax has to be paid by the buyer, the relevant price for the buyer is the tax-inclusive price \( p + \kappa \). At \( \bar{p}_s \), it holds that \( E_s[u_b(x, \bar{p}_s, \tau, \kappa, 1)] = 0 \). Thus, if \( \kappa \) is increased, the net-of-tax price \( \bar{p}_s \) must be lowered by exactly the same amount such that the tax-inclusive price remains unchanged: \( \partial (\bar{p} + \kappa) / \partial \kappa = 0 \). By definition of \( p_H \), the same arguments show that \( \partial (p_H + \kappa) / \partial \kappa = 0 \).

Regarding \( p_H \), recall that \( V_H \) is strictly decreasing in \( \kappa \) (Lemma A.2(i)). Therefore, if the buyer’s participation constraint is binding at \( p_H \) (\( V_H(p_H, \tau, \kappa) = \gamma \)) and \( \kappa \) is increased, then again \( p_H \) must be lowered by the same amount such that \( \partial (p_H + \kappa) / \partial \kappa = 0 \). Now suppose instead that the buyer’s participation constraint is not binding (\( V_H(p_H, \tau, \kappa) > \gamma \)). Then, \( p_H \) is the solution to the first order condition \( \partial E_s[u_s(x, p, \tau, \kappa, q^*(x, p, \tau, \kappa)) / \partial p = 0 \); hence, \( p_H \) solves

\[
(v_s(p_H + \kappa) - p_H)F'(p_H + \kappa) + 1 - F(p_H + \kappa) = 0.
\]
With \( \partial(p_H + \kappa) / \partial \kappa = \partial p_H / \partial \kappa + 1 \), total differentiation yields
\[
\frac{\partial p_H}{\partial \kappa} + 1 = \frac{-(v'_q(p_H + \kappa) - 1)F'(p_H + \kappa) + (v_q(p_H + \kappa) - p_H)F'(p_H + \kappa) + 1}{(v'_q(p_H + \kappa) - 2)F(p_H + \kappa) + (v_q(p_H + \kappa) - p_H)F(p_H + \kappa)} \]
\[
= - \frac{F'(p_H + \kappa)}{E[u_q(x, p, \tau, \kappa, q'(x, p, \tau, \kappa))] |_{p = p_H}} > 0.
\]

Therefore, a marginal increase in \( \kappa \) strictly increases the tax-inclusive price \( p_H + \kappa \) if the buyer’s participation constraint is not binding.\(^{23}\) It is worth mentioning that this result is robust to the case of an ad valorem sales tax (where the tax-inclusive price equals \((1+\kappa)p\)).\(^{24}\)

Part (ii): Since the seller’s decision whether to trade is based only on the net-of-tax price \( p \), it follows directly that \( \bar{p} \) and \( p_H \) are independent of \( \kappa \). Moreover, if for a price \( p_H \) the seller’s participation constraint is binding such that \( V_H(p_H, \tau, \kappa) = \gamma \), then \( \partial V_H / \partial \kappa = 0 \) (Lemma A.2(ii)) implies that \( \partial p_H / \partial \kappa = 0 \). (Even if the buyer wants to shift part of the tax increase to the seller by lowering his offer, this is not possible because then the seller would prefer his outside option of no trade.)

If instead \( V_H(p_H, \tau, \kappa) \gg \gamma \), then \( p_H \) solves the first order condition
\[
\frac{\partial}{\partial p} E[u_q(x, p, \tau, \kappa, q'(x, p, \tau, \kappa))] = (v_q(p) - (p + \kappa))F'(p) - F(p) = 0.
\]

Total differentiation yields
\[
\frac{\partial p_H}{\partial \kappa} = - \frac{F'(\kappa)}{E[u_q(x, p, \tau, \kappa, q'(x, p, \tau, \kappa))] |_{p = p_H}} < 0.
\]

Again, this result on the sales tax does not qualitatively depend on the sales tax being a per unit tax; if instead we consider an ad valorem sales tax \( \kappa \), which raises the buyer’s price from \( p \) to \((1+\kappa)p\), then, by total differentiating, we also obtain \( \partial p_H / \partial \kappa < 0 \) if the seller’s participation constraint is not binding.

### A.7 Proof of Proposition 3

Part (i): By Lemma 3(i), if the seller makes the offer, the tax-inclusive price is increasing in \( \kappa \), which reduces the probability that an informed buyer buys. By Lemma 3(ii), if the buyer makes the offer, the net-of-tax price is decreasing in \( \kappa \), which again leads to less trade. In both

\(^{23}\) Note that, for the net-of-tax price, it is not obvious whether \( \partial p_H / \partial \kappa \) is positive or negative. If, for instance, \( F \) is a uniform distribution and \( v_q(x) = 0 \) (the seller derives no value from holding the asset), then \( \partial p_H / \partial \kappa = -0.5 \); The seller shifts 50% of the tax increase to the buyer and reduces the net-of-tax price by the remaining amount.

\(^{24}\) For an ad valorem sales tax, we obtain, \( \partial((1+\kappa)p_H) / \partial \kappa = -v_q((1+\kappa)p_H)F((1+\kappa)p_H)E[u_q(x, p, \tau, \kappa, q')] | \partial \kappa^2 \)

which is strictly positive unless \( v_q(x) = 0 \). The latter case is a special case in which the optimal tax-inclusive price \( z = (1+\kappa)p_H \) is independent of \( \kappa \).
cases, the probability of trade is strictly reduced if and only if the responder’s participation constraint does not bind ($V_H(p_I, \tau, \kappa) > \gamma$).

Part (ii): Suppose first that the seller is the proposer. From Lemma 3(i), $\partial (p_I + \kappa) / \partial \kappa = 0$ and $\partial (p_{II} + \kappa) / \partial \kappa \geq 0$. Since $u_S(x, p_I, \tau, \kappa, 1) = p_I$, we get

$$\partial u_S(x, p_I, \tau, \kappa, 1) / \partial \kappa = \partial p_I / \partial \kappa = \partial (p_I + \kappa) / \partial \kappa - 1 = -1.$$  

Regarding the candidate price $p_{II}$, notice that

$$E[u_S(x, p_{II}, \tau, \kappa, q^*(x, p_{II}, \tau, \kappa))] = \int_{\tau}^{\tau + \kappa} v_s(x) dF(x) + \int_{\tau}^{\tau + \kappa} p_{II} dF(x).$$

Suppose first that $\partial (p_{II} + \kappa) / \partial \kappa = 0$. Then,

$$\partial E[u_S(x, p_{II}, \tau, \kappa, q^*(x, p_{II}, \tau, \kappa))] / \partial \kappa = (1 - F(p_{II} + \kappa))(\partial p_{II} / \partial \kappa) = -(1 - F(p_{II} + \kappa)).$$

Thus, the seller’s profit from charging $p_{II}$ decreases by less than his profit from charging $p_I$, and $\gamma$ shifts to the right if $\kappa$ is increased ($\partial \gamma / \partial \kappa > 0$). Now suppose that $\partial (p_{II} + \kappa) / \partial \kappa > 0$. If the equilibrium candidate price $p_{II} + \kappa$ is increased following a tax increase, the seller must be strictly better off than if he had not changed the price (which would have been possible; lower prices would not violate the buyer’s participation constraint). But as shown before, even if $p_{II} + \kappa$ remained unchanged, the seller would, at $\gamma = \gamma$, strictly prefer $p_{II}$ over $p_I$. Therefore, this must still hold true if the seller adjusts the price $p_{II}$ such that $\partial (p_{II} + \kappa) / \partial \kappa > 0$. Hence, again we get $\partial \gamma / \partial \kappa > 0$.\(^{25}\)

If the buyer is the proposer, indifference of the buyer as the proposer at $\gamma = \gamma$ implies that

$$E[v_s(x)] - (p_I + \kappa) = \int_{\tau}^{\tau + \kappa} (v_s(x) - (p_{II} + \kappa)) dF(x).$$

By Lemma 3(ii), a marginal increase in $\kappa$ has no effect on $p_I$ but increases the buyer’s tax burden. The marginal change in the buyer’s profit is $-1$ (which can be obtained by deriving the left hand side in the above equality with respect to $\kappa$). Again by Lemma 3(ii), if the seller’s participation constraint is binding, a marginal increase does not have any effect on $p_{II}$ either; however, the buyer faces a higher tax burden only with probability $F(p_{II})$ (in case he buys).\(^{26}\) Therefore, the marginal change in the buyer’s profit when offering $p_{II}$ is equal to $-1$.

\(^{25}\) Qualitatively the same result holds for an ad valorem transaction tax (levied as percentage of the price): Due to the same comparative statics effects for $p_I$ and $p_{II}$ as in Lemma 5 (unless $v_s(x) = 0$ for all $x < (1+\kappa)p_{II}$ in the case where the seller is the proposer), similar arguments as in the proof of Proposition 3 can be applied for an ad valorem tax.

\(^{26}\) In case of a per unit transaction tax, the change in the tax burden does not depend on the price. For an ad valorem tax, this is no longer true; here, however, the argument becomes even stronger: Since it holds that $p_{II} < p_I$ (the buyer offers a lower price when buying from an informed seller who only sells in low payoff states), the increase in the tax-inclusive price for a given increase in the ad valorem transaction tax is lower if the buyer offers $p_{II}$. 

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\( F(p_{II}) > -1 \). Moreover, if the seller’s participation constraint is not binding, it holds that \( \partial p_{II}/\partial \kappa < 0 \). The first order effect of this marginal change in the optimal price \( p_{II} \), however, is equal to zero, and again the marginal change in the buyer’s profit when offering \( p_{II} \) is equal to \( -F(p_{II}) > -1 \). (This can easily be verified by deriving the right hand side of the above equation with respect to \( \kappa \), taking into account that \( \partial E_x[u_b(x,p_{II},\tau,\kappa,q^*)]/\partial p_{II} = 0 \) if \( p_{II} \) is the unconstraint maximum.) Since the buyer’s expected profit from offering \( p_I \) is reduced more strongly than his expected profit from offering \( p_{II} \), the buyer now strictly prefers \( p_{II} \) over \( p_I \) if \( \gamma = \gamma^* \). Hence, \( \partial \gamma^*/\partial \kappa > 0 \).

**APPENDIX B**

In this appendix we analyze the effects of taxation on the proposer’s incentives to produce information before making the price offer. We are focusing on the cases where absent of the ability of the proposer to acquire information (or in case his information cost is high), the proposer chooses to avoid information production by the responder. We consider a framework which is identical to the main model, except for the followings: First, we allow the proposer to learn the asset’s payoff \( x \) at cost \( \gamma_P \) before he makes the price offer; we assume information production of the proposer to be unobservable to the responder and that the proposer cannot credibly reveal any private information. Second, for simplicity we ignore taxation of the responder’s profits and the effects of taxation on the responder’s decision to acquire information, which has been considered in the main analysis.

Consider the candidate equilibrium in which no agent acquires information. Here, the candidate equilibrium price \( p^* \) is either equal to \( \bar{p} \) (as given in Definition 2(i) such that the responder is indifferent between trading uninformed and not participating) or equal to \( p_I \) (as given in Definition 2(ii) such that the responder is indifferent between trading uninformed and information production); compare also Proposition 1. If the proposer deviates from this candidate equilibrium and produces information, his price choice depends on the responder’s posterior beliefs about \( x \) conditional on the offer \( p \). We assume the following out-of-equilibrium beliefs of the responder: If the proposer offers a price \( \hat{p} \neq p^* \), the responder thinks that the asset’s payoff is such that trade is most unfavorable for him; that is, the buyer as the responder believes that \( x = x_L \) with probability one and the seller as the responder believes that \( x = x_H \) with probability one. (We still assume that \( x \) is continuous.) Given these
beliefs, a proposer who deviates from the candidate equilibrium and acquires information only considers to trade at the candidate equilibrium price. Define the trading rule \( \tilde{q}(x, p, \tau, \kappa) \) such that \( \tilde{q}(x, p, \tau, \kappa) = 1 \) if \( u_p(x, p, \tau, \kappa, 1) \geq u_p(x, p, \tau, \kappa, 0) \) and \( \tilde{q}(x, p, \tau, \kappa) = 0 \) otherwise. Then, the proposer gets an expected utility of \( \mathbb{E}[u_p(x, p, \tau, \kappa, 1)] \) in the candidate equilibrium and gets an expected utility of \( \mathbb{E}[u_p(x, p, \tau, \kappa, 0)] - \gamma_p \) if he deviates and acquires information. Thus, the proposer does not deviate if and only if \( V_p(p^*, \tau, \kappa) \leq \gamma_p \) where \( V_p(p, \tau, \kappa) := \mathbb{E}[u_p(x, p, \tau, \kappa, \tilde{q}(x, p, \tau, \kappa))] - \mathbb{E}[u_p(x, p, \tau, \kappa, 1)] \).

Consider first the effect of a profit tax increase on the proposer’s incentive to acquire information and suppose for simplicity that the transaction tax is equal to \( \kappa = 0 \).

**Proposition B1**

If the proposer can acquire information, an increase in the tax rate \( \tau \) on the proposer’s profits enlarges the range of the information cost \( \gamma_p \) for which trade takes place with probability one.

**Proof of Proposition B1**

We show that, for a given candidate equilibrium price, an increase in the profit tax \( \tau \) reduces the value of information \( V_p(p^*) \) and therefore enlarges the range for the information cost \( \gamma_p \) for which the proposer does not want to deviate and produce information. Note that the proof does not need to distinguish whether the candidate equilibrium price is \( p^* \) or \( p_I \). We allow for the possibility of a loss offset as in Section 5.1.

Case (a): Suppose the seller is the proposer. The seller's expected utility in the candidate equilibrium is

\[
\mathbb{E}[u_S(x, p^*, \tau, \kappa, 1)] = p^* - \tau \max\{p^* - p_0, 0\} + \lambda \tau \max\{p_0 - p^*, 0\}.
\]

The seller gets the price \( p^* \) and pays a profit tax if \( p^* > p_0 \) where \( p_0 \) is the price initially paid and is deductible for tax purposes; otherwise, if \( p^* < p_0 \), the seller's accounting profits are negative and the loss offset rule applies (losses are “subsidized” at rate \( \lambda \geq 0 \)). If the seller deviates and acquires information, he trades at the candidate price \( p^* \) if and only if \( v_S(x) \leq p^* \), which yields

\[
27\text{The seller as the proposer would have to choose} p = x_L \text{in order to make the buyer willing to trade and prefers the higher candidate equilibrium price} p^* \in \{p_I, p\} \text{to} p = x_L. \text{The buyer as the proposer would have to choose} p = x_H \text{in order to make the seller willing to trade and prefers the candidate equilibrium price over} p = x_H.
\]
and consists of the seller’s expected utility when \( x \) is low and he sells (the first integral) and the seller’s expected utility when \( x \) is high and he does not sell (the second integral), disregarding the cost of information. For the seller as the proposer, the value of deviating and producing information is equal to

\[
V_p = \int_{v_s^{-1}(p^*)}^{u} (v_s(x) - p^*) dF(x) - \int_{v_s^{-1}(p^*)}^{u} (\tau \max\{x - p_0, 0\} - \tau \max\{p^* - p_0, 0\}) dF(x)
\]

which directly implies that \( \partial V_p/\partial \tau < 0 \). If instead \( p^* \leq p_0 \), then

\[
V_p = \int_{v_s^{-1}(p^*)}^{u} (v_s(x) - p^*) dF(x) + \int_{\max\{p_0, v_s^{-1}(p^*)\}}^{u} \lambda \tau(p_0 - x) dF(x)
- \int_{\max\{p_0, v_s^{-1}(p^*)\}}^{u} \lambda \tau(p_0 - p^*) dF(x)
\]

which again yields \( \partial V_p/\partial \tau < 0 \). Intuitively, if \( \tau \) is increased, the seller pays more taxes if he does not sell and \( x \) turns out to be high, and he gets a higher subsidy if he sells and realizes a negative accounting profit \( p^* - p_0 \leq 0 \); both effects lower \( V_F \) and, hence, the threshold above which trade takes place with probability one.

Case (b): Suppose the buyer is the proposer. The buyer’s expected utility in the candidate equilibrium is

\[
E_{\bar{v}_B}(x, p^*, \tau, \kappa, \bar{q}(x, p^*, \tau, \kappa)) = E_{\bar{v}_B}(x) - p^* + \int_{v_s}^{v^*} \lambda \tau(p^* - x) dF(x) - \int_{v_s}^{v^*} \tau(x - p^*) dF(x),
\]

28 Intuitively, if \( \tau \) is increased, the seller pays more taxes if he does not sell and \( x \) turns out to be high; in addition, if \( p^* \leq p_0 \), he gets a higher subsidy if he sells and realizes a negative accounting profit.
that is, his expected utility from buying the asset plus/minus the expected tax payment (which depend on whether the asset’s payoff turns out to be lower or higher than the price paid). If the buyer deviates and acquires information, he proposed the candidate price $p^*$ if and only if $v_B(x) \geq p^*$ and does not participate otherwise (or proposes any $p < p^*$, for instance). With $v_B(x) > v_S(x) = x$, the buyer's deviation payoff is

$$E_u [u_B(x, p, \tau, \kappa, \tilde{q})] = \int_{\tilde{u}^L(p^*)}^{u_B(x)} (x - p^*) dF(x) + \int_{\tilde{u}^R(p^*)}^{p^*} \lambda \tau (p^* - x) dF(x) - \int_{p^*}^{u_B(x)} \tau (x - p^*) dF(x).$$

Therefore, the buyer does not deviate from the candidate equilibrium if and only if $\gamma_B$ is larger than

$$V_B = \int_{u_B}^{\tilde{u}^L(p^*)} (p^* - v_B(x)) dF(x) - \int_{u_B}^{\tilde{u}^R(p^*)} \lambda \tau (p^* - x) dF(x).$$

This threshold is determined by an informed buyer’s gain from avoiding to buy the asset in low payoff states (the first term), corrected by the tax payment in this case (the second term). Since $v_B^{-1}(p^*) < p^*$, we get $\partial V_B / \partial \tau \leq 0$, with strict inequality if and only if $\lambda > 0$. This result mirrors the result for $V_I$ in the main analysis which is independent of $\tau$ for the buyer as the responder if $\lambda = 0$ (Lemma A.1(i)) and strictly decreasing in $\tau$ if $\lambda > 0$ (compare Figure 3). Since the buyer acquires information in order to avoid the loss of buying in low payoff states, the profit tax affects the buyer’s value of information (as responder or proposer) only if there is a tax treatment of losses. QED

The proof of this result and its intuition are similar to showing that the value of information $V_I$ for the responder is decreasing in $\tau$. By reducing the proposer’s gain from deviating to information acquisition, profit taxation makes it more likely that trade is efficient in equilibrium. The seller as the proposer benefits from information acquisition in high payoff states where he would not sell when being informed; higher profit taxes reduce this benefit. The buyer as the proposer benefits from information acquisition in low payoff states where he would not buy when being informed; taxation of positive profits does not affect this informational benefit, but as soon as there is a tax treatment of losses, the value of information of the buyer as proposer is strictly reduced. Thus, profit taxation lowers the threshold for the information cost above which there is trade with probability one and, hence, enlarges the range in which all gains from trade are realized.

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29 Intuitively, since $p^*$ is not affected by an increase in the tax on the proposer's profits, it follows directly that $\partial V_B / \partial \tau \leq 0$, with strict inequality if and only if $\lambda > 0$. 

32
Now consider the effect of an increase in the transaction tax $\kappa$ on the proposer’s incentive to acquire information and assume for simplicity that $\tau = 0$.

**Proposition B2**

If the proposer can acquire information, an increase in the transaction tax $\kappa$ reduces the range of the information cost $\gamma_P$ for which trade takes place with probability one.

**Proof of Proposition B2**

Recall that the sales tax is levied on the buyer. Suppose first that the seller is the proposer. With $p^*$ is the net-of-tax candidate equilibrium price which the seller proposes, we get

$$V_P = \int_{(p^*)}^{u} (v_s(x) - p^*)dF(x),$$

since the seller gains from deviating if and only if $v_s(x) > p$. For the seller as proposer, $V_P$ depends on $\kappa$ only through the effect of $\kappa$ on the candidate equilibrium price. Since, by Lemma 3(i), $\bar{p} + \kappa$ and $p_I + \kappa$ are independent of $\kappa$, $p^*$ must be strictly decreasing in $\kappa$. Thus, we get $\partial V_P / \partial \kappa > 0$. Intuitively, a higher transaction tax reduces the seller’s gains from trade and hence increases his incentive to deviate and learn the true payoff of the asset, in which case he trades less often.

If the buyer is the proposer, then

$$V_P = \int_{(p^*+\kappa)}^{u} ((p^* + \kappa) - v_b(x))dF(x),$$

since the buyer’s value of producing information corresponds to the value of avoiding a loss in low payoff states (which occurs if and only if $v_b(x) < p^* + \kappa$). By Lemma 3(ii), $\bar{p}$ and $p_I$ are independent of the sales tax levied on the buyer; thus, $\partial(p^* + \kappa)/\partial \kappa > 0$, which implies that $\partial V_P / \partial \kappa > 0$. If $\kappa$ goes up, the buyer’s loss from buying the asset in low payoff states is increased and, thus, the range in which the buyer as the proposer trades uninformed becomes smaller. QED

Transaction taxes make trade more expensive and thus increase the proposer’s incentive to deviate to information acquisition and learn the true payoff of the asset. In the latter case, individually unfavorable trades can be avoided, which becomes more valuable if the transaction tax is increased. Thus, the range in which there is trade with probability one becomes smaller and mutually beneficial trade becomes less likely.

Altogether, profit taxation may help to solve the signaling problem by reducing the incentives to make use of an informational advantage. In contrast, a transaction tax makes trade less
attractive and increases the proposer’s incentive to produce information. These results for the case where both parties can acquire information confirm the intuition for the mechanisms underlying the effects of taxation in markets where information is endogenous.
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