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## An Acquiring-a-Company Experiment with Value Messages and Information Leaks

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**Abstract**

In an ultimatum bargaining, we investigate lying as falsely stating what one privately knows without, however, excluding that others find out the truth. Specifically, we modify the Acquiring-a-Company game. Privately informed sellers send messages about the alleged value of their company to potential buyers. Via random information leaks, they can also learn the true value before proposing a price which the seller finally accepts or not. Two-thirds of all sellers exaggerate the company's value (especially if the true value is small) but increasing the leak probability surprisingly only mildly increases truth telling. Instead, it reduces the size of the lies. Moreover, it decreases overreporting (exaggerating the value to sell at a higher price) but increases underreporting (stating values below the actual ones to increases chances of trade). Buyers who found out value misreporting anchor their price proposals on the true value but do not explicitly discriminate against liars. In contrast, sellers are fully opportunistic and make their acceptance decision mainly dependent on whether the resulting payoff is positive. Thus, morality concerns do not seem to matter much in this market exchange. Altogether probabilistic leaks enhance trade and welfare what suggests to politically facilitate and encourage e.g. whistle blowing.

**JEL Codes**: C78 · C91 · D83 · D91

**Keywords**: Acquiring-a-company experiments · Information leaks · Cheap talk · (Not) Lying · Ultimatum bargaining

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# 1 Introduction

The moral wiggle room effect (e.g. Dana et al., 2007) seems to suggest that we are much more reluctant to misreport what one privately knows when this can be revealed via information leaks. But does the possible revelation of the truth crowd out misreporting or only weakens the extent of misreporting when information leaks are more likely? Since selling at high prices is desirable, profit-maximizing sellers might exaggerate the value of what they offer for sale. But worse than selling too cheaply is not selling at all, e.g., due to being found out lying. We analyze lying in a market context with privately value-informed sellers as rather typical for many field situations and discussed in the literature of trade with private information (see Akerlof, 1978 who studies "lemons markets" and for early experimental research Bazerman and Samuelson, 1983). Exploiting private information advantages can be questioned when so far uninformed buyers can learn the true values of sales items. How does this change the decision-making situation change? Would sellers still offer overvalued items risking that buyers might not buy in the first place? Like obliging second-hand car dealers to reveal known but not easily recognizable damages of their cars, sellers might be hold responsible for false statements or unrealistic promises if the buyers find out about their lies. In the field, however, sellers may claim unawareness about the truth themselves which may render intentional fraud not verifiable in court. Information leaks, e.g. due to whistle blowing, would instead alert potential buyers before dealing and could avoid legal regulation. One might even hope that the mere possibility of information leaks already prevents being exploited by privately informed sellers. If so, policy makers should encourage informational leaks. One may even reward whistle blowing.[1] This would boost efficiency enhancing exchange in case of asymmetric information.

To shed light on such market exchange situation we modify the Acquiring-a-Company (AaC) experiment (Bazerman and Samuelson, 1983, Samuelson and Bazerman, 1985) in which a seller owns a company which is evaluated higher by a potential buyer. Like the standard AaC game, our experiment relies on stochastic ultimatum bargaining between these two.[2] One modification lets the privately informed seller first send a numerical message regarding a company's alleged value. That value message can be true or false where the lie of a misreport can be in two directions. Either the seller lies upwards and exaggerates the value of the company by an overreport to sell it for as much as possible. Or the seller lies downwards and understates it by an underreport which reduces the seller's payoff but increases the chances of trade. Another modification is that, with a commonly known probability, the seller's private value information is leaked to the buyer. Hence, the buyer becomes aware not only of the true value, but whether the seller has been misreporting. Being so informed or not the buyer then proposes a price to acquire the company which the seller can accept (such that the company is sold) or reject. Like in the AaC-set up trade is welfare increasing since the seller proportionally underevaluates the company. Across rounds, we vary the commonly known proportional under-evaluation and, most importantly, the leak probability. Both, seller and buyer participants, will be aware of both parameters when interacting across several successive rounds. Partners in the other role randomly change in order to discourage reputation effect. We refer

[1] Actually the metaphoric framing of "Prisoners' Dilemma" games is based on rewarding of "whistle blowing".

[2] In fact, it has been largely overlooked (see also Samuelson and Bazerman, 1985) that it actually seems to be the first stochastic ultimatum experiment. This paradigm can be also used to analyze, for instance, buyer competition or loss aversion of buyers suffering losses even in case of equilibrium trade.

to our modified Acquiring-a-Company experiment with information leak as *LAaC*.

With our experiment and the elicitation of stochastic and deterministic ultimatum bargaining in one overarching ultimatum experiment we try to answer the following research questions: What is the effect of a higher likelihood of information leaks on misreports by sellers? Does it increase the share of truthful reports? Does it reduce the size of the lies? Or does it affect the direction of lying, i.e. over- versus underreporting? What do uninformed buyers base their price proposals on and how do informed buyers react when they realize they have been lied to? What in turn determines the sellers' acceptance of price proposals? Finally, do information leaks lead to more trade overall and thus to an increase in welfare?

Our result are as follows. Most value messages are false (85.5 %), exaggerating the company's value in more than two-thirds of all cases. In contrast, nearly one-third of all false value messages are underreports. In general, increasing the leak probability from 10 % to 40 % surprisingly has only little effect on the frequency of truthful reports. What such a variation in probability does alter, however, is the size of the lies on the one hand and the structure of misreports on the other. A higher leak probability reduces the average size of the lie (i.e. the difference between the true and the reported value), leads to a decrease in overreporting and a simultaneous increase in underreporting which can be considered evidence for sellers striving a positive social image as modest. Moreover, underreporting and truthtelling increase with the value of the company to increase chances of trade. Overreporting is mostly concentrated at small to medium company values. Price proposals of buyers unaware of the true value anchor on the value message and show a certain path dependency, while those who found out value misreporting, anchor on the true value. However, they do not explicitly discriminate against liars but rather exhibit a certain inertia in suspicion: interacting with an overreporting seller in the past makes them propose lower price offers in future rounds. In contrast, sellers are fully opportunistic and make their acceptance decision mainly dependent on whether the resulting payoff is positive. Thus, morality concerns do not seem to matter much in this market exchange. Altogether probabilistic leaks enhance trade and thereby also welfare. This suggests that policy makers should encourage them and promote, e.g., whistle blowing.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 explains our modified Acquiring-a-Company game with information leaks. Section 4 presents the experimental protocol and states some behavioral predictions. The experimental results are presented in Section 5. Section 6 concludes.[3]

## 2 Related Literature

Morally it may already be questionable to not tell others that one privately knows something relevant, as studied by Dana et al. (2007)) whose design employs a non-commonly known setup. Our research instead relies on a commonly known game form, namely a stochastic ultimatum bargaining setup with incomplete information. Strategic lying is mainly explored in modified ultimatum experiments by letting privately informed proposers lie about the pie size via pie-size messages (Mitzkewitz and Nagel, 1993). These could inform when to expect a more or less known share of truthful proposers and whether this in turn renders it worthwhile for opportunistic proposers to lie by overstating the pie size (Besancenot et al., 2013). Actually, pie-size messages become more deceptive the larger the pie (Vesely, 2014). Proposer

[3] Appendix B contains the translated version of the experimental instructions.

messages can also concern the responder's outside option which should be respected via increased offers (Boles et al., 2000, Croson et al., 2003). Alternatively, responders may send messages about a (non-)favorable ECU-euro conversion rate[4] to induce higher offers by proposers (Koning et al., 2011). All these studies confirm substantial untruthfulness of messages but less deception when information is only indirectly transmitted via possibly information-revealing actions (Kriss et al., 2013).

In theory, pure cheap talk is ineffective (Kim, 1996) although it may matter behaviorally in experimental bargaining (Croson et al., 2003). However, when lies may be verifiable, messages are no longer cheap talk. Therefore, it is particularly interesting to investigate how probabilistic lying detection affects individual inclinations to send (un)truthful messages in bargaining and the interpersonal heterogeneity of such behaviors. So far the evidence indicates that proposers lie less in case of 50 %-detection probability, compared to no detection at all (Anbarcı et al., 2015); lowering the probability of detection weakens the effect, for instance, a detection probability of even 25 % does not prevent proposers from understating the pie size (Chavanne and Ferreira, 2017).

Our experiment employs the rather complex AaC-paradigm with perfectly (and linearly) correlated evaluations what allows to investigate the winner's curse (see Bazerman and Samuelson, 1983, who additionally use an auction to explore this phenomenon).[5] Specifically, we did not expect significant altruistic sanctioning - a major and influential finding of deterministic ultimatum experiments - when information is not leaked. The reason seems to be that in crucially stochastic environments random interpersonal payoff comparisons are rather cumbersome.[6] Our

[4]ECU standing for *e*xperimental *c*urrency *u*nit.

[5]Güth et al. (2020) rely on a simpler stochastic ultimatum game which avoids such correlated evaluations and actually considers only the broader case $q$=1 of Acquiring-a-Company game.

[6]Like Güth et al. (2020) we refrain from clearly defining when stochasticity is "crucial" what

LAaC-setup induces common(ly known) risk neutrality[7] and allows for leaking value information to the buyer.

From a broader perspective, our analysis on the perceived (im)morality of lying when bargaining in asymmetric information settings also contributes to the literature on the so-called "dark side" of human nature, particularly lying on the one hand, and detecting lies e.g. through whistle blowing on the other. The rapidly growing literature on lying mostly examines lies that increase one's payoff. In contrast, deviations from truthful reports that result in a reduced payoff - for which Abeler et al. (2019) coined the term downward lies (cf. definition 4) - are not included even in recent theoretical models of lying costs (Abeler et al., 2019; Gneezy et al., 2018; Khalmetski and Sliwka, 2019). To date, only a few papers have shed initial light on downward lying, arguing that subjects use it to signal honesty (Barron, 2019, Geraldes et al., 2021, Utikal and Fischbacher, 2013). Our setting provides a framework in which we can observe both classical lying for one's own maximum advantage by sellers overreporting the company value and lies that are less profitable than truthful statements namely when sellers underreport the value. However, the motive for such downward lies is more complex in our case. In addition to the desire to appear honest in order to maintain an honest self and social image, there is also an ambivalent monetary component. On the one hand, higher misrepresentations of the company's value would lead to a higher payoff in the event of trade. On the other hand, too high value messages can also have a deterrent effect on the buyer, so that the trade does not take place at all. There is a particular risk of this happening

should be attempted only in view of richer data. What is meant by "crucial" is that we do not claim crowding out altruistic sanctioning when stochastic effects are minor e.g. due to just binary random events.

[7]By employing binary-lottery incentives one earns the large and the small reward with positive probability irrespective of the own success. Thus, participants' LAaC-payoffs linearly determine their probability for the large reward.

if the true value of the company is actually high. In this case, the risk of a failed trade dominates the possible additional profit through overreporting, but also the fair profit through truth telling. As a consequence, downward lying occurs since sellers may underreport. A detailed consideration of these aspects is new in the literature on lying.

Our work also contributes to the literature that deals with the detection of lies. This can be done, for example, through whistle blowing, which is an effective mechanism to stop wrongful behavior in the first place. Whistle blowing has become recently investigated in experimental economics to the aim to assess its underlying intrinsic motivations (Reuben and Stephenson, 2013): how and through which channels do fines, leniency or rewards for reporting illicit activities affect cartel formation (Bigoni et al., 2012, Bigoni et al., 2015) and how effective are rewards for self-reporting bribery in the public sector (Serra, 2012, Abbink and Wu, 2017)? Differences in the social valuation of whistle blowers are equally important, as is the extent of harm caused by the misconduct (e.g. Butler et al., 2020). Our setting adds to this literature in terms of the positive effect of a reduction of asymmetric information. Reducing the advantages of lying, may benefit a society implementing compliance and enhancing trade.

# 3 The Acquiring-a-Company game with information leaks (LAaC)

The only potential buyer $B$, when owning seller $S$'s company, would evaluate it by $v \in (0, 1)$. However, only seller $S$ is aware of $v$ whereas for buyer $B$ the value $v$ is uncertain and expected to be uniformly distributed in $(0, 1)$, denoted by $v \in U(0, 1]$.

The seller, aware of $B$'s expectations, evaluates the company via $qv$ where the parameter $q$ with $0 < q < 1$ is commonly known. Seller $S$ can send a value message $\hat{v} \in [0,1]$ to $B$ which might be revealing, i.e., $\hat{v}(v) = v$ for all $v$, but also false, i.e. $\hat{v}(v) \neq v$ for $v \in (0,1)$.[8] The total surplus from trade equals $(1-q)v$ and is always positive. Therefore, trade is always welfare enhancing.

The innovation of our setup is that private value information can be leaked and learned by $B$. With probability $w \in (0,1)$ buyer $B$, after receiving the value message $\hat{v}$ from the seller $S$ but before proposing the price $p \in [0,1]$, may also learn the true valuation $v$, respectively $qv$. So with probability $w$ the buyer would offer a price $p \in [0,1]$ to seller $S$, aware of both, the value message $\hat{v}$ and the true value $v$. This is denoted by $p = p(\hat{v}, v) \in [0,1]$. With the complementary probability $1-w$ buyer $B$ only knows $\hat{v}$, the value message of seller $S$, when offering a price, denoted via $p = p(\hat{v}) \in [0,1]$. Finally seller $S$ accepts or rejects the proposed price $p$.

The decision process proceeds as follows:

1. Chance randomly selects $v \in (0,1]$, as expected by $B$, and only $S$ learns its realization $v$.

2. $S$ sends a value message $\hat{v}$ to $B$.

3. With probability $w$ chance reveals the value realization $v$ also to $B$, resp. not with probability $1-w$.

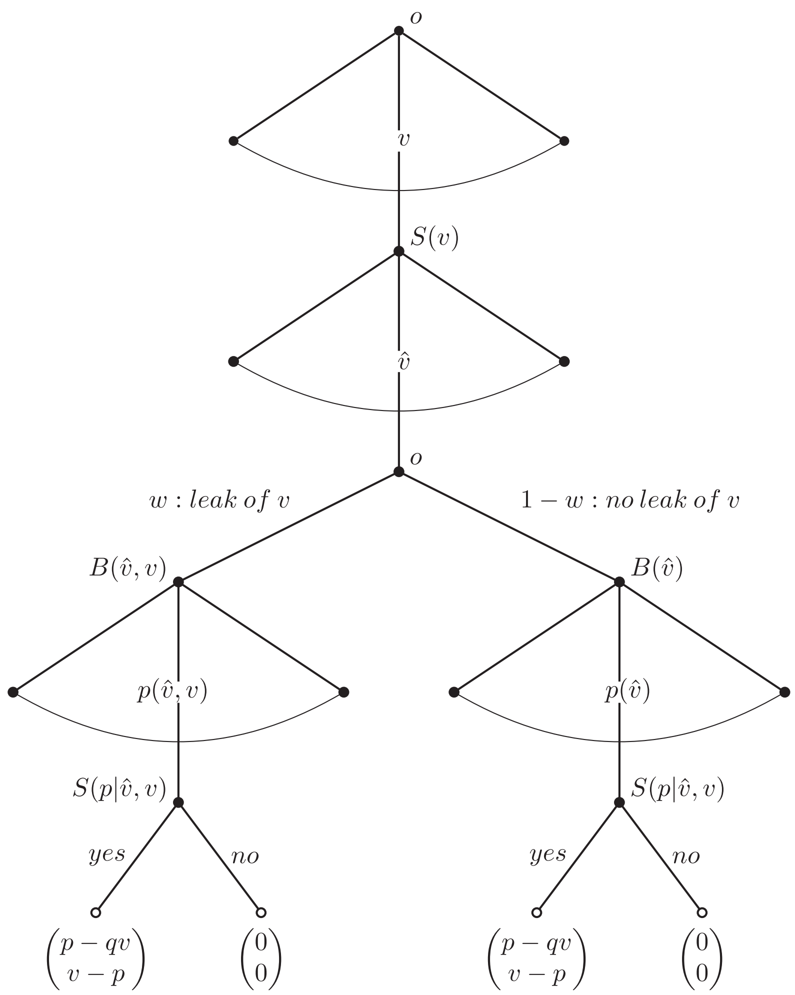
4. $B$, aware only of $\hat{v}$ or of both, $\hat{v}$ and $v$, offers a price $p$ to $S$.

5. $S$, aware whether $B$ also knows $v$, accepts the price $p$, denoted by $\delta(p) = 1$, or not, denoted by $\delta(p) = 0$.

[8]Since sellers are fully aware of $v$ any misreport is a conscious decision and can not be excused by moral ignorance as studied by Serra-Garcia and Szech (2021) or Simon (2020).

Figure 1 illustrates the time structure of LAaC-play.

Figure 1: Time structure of game play




For each $v \in (0,1)$ and given $q$ with $0 < q < 1$, seller $S$ earns $\delta(p)(p - qv)$ and $B$ earns $\delta(p)(v - p)$. Apparently both parties can lose; $S$ when accepting a price smaller than $qv$ and B when a price proposal $p > v$ is accepted by $S$.

The benchmark solution for common(ly known) risk and loss neutrality and opportunism (in the sense of maximizing the own monetary payoff expectation) can be derived via backward induction. Optimal acceptance requires $\delta(p) = 1$ for $p \geq qv$

and $\delta(p) = 0$ otherwise. Anticipating this we first focus on the no-leak event. Here $B$ expects to earn:

$$\int_{\frac{p}{q} \geq v > 0} (v - p) dv = \frac{p^2}{2q^2}(1 - 2q)$$

So the optimal price is $p^* = 0$ for $q > \frac{1}{2}$ and $p^* = q$ otherwise since $p^* = q$ is the lowest price guaranteeing trade for all $v \in (0, 1]$. Our experiment considers both, $q > \frac{1}{2}$ implying no-trade prediction like Akerlof (1978) and $q < \frac{1}{2}$ which implies welfare enhancing trade with positive surplus $(1 - q)v$ due to $v > 0$ and $q < 1$.

In case of the leak event with probability $w$ buyer $B$, aware of $q$, $\hat{v}$ and $v$, should offer prices $p^*(\hat{v}, v) = qv$ as a function of value $v$, i.e., $p^*(\hat{v}, v) = qv$ for all $v \in (0, 1]$ where we abstract from the technicality that, in case of $p^*(\hat{v}, v) = qv$, seller $S$ is indifferent between accepting and rejecting. So with leak probability $w$ the no trade result for all $v \in (0, 1]$ and parameter $q > \frac{1}{2}$ is avoided. Like in non-embedded deterministic ultimatum games, there exist also other equilibria in weakly dominated response strategies but not in line with sequential rationality (Selten, 1975).

# 4 Experimental protocol

**Overview.** Before the first round half of all participants are randomly assigned to the role of a buyer while the others become sellers. Participants keep their roles throughout the 16 rounds of the experiment. At the beginning of each round, each buyer is randomly matched with one seller with whom to bargain about buying or not the seller's company.[9] Participants learned about their individual payoff at the end of each round. After the last round, everyone also had to answer a socio-economic

[9] We used random matching groups with six participants each, for a total of 17 such groups. Participants were not aware of such restricted matching.

questionnaire.[10]

**Experimental task.** A buyer and seller bargain whether to trade or not, i.e., whether the buyer acquires the company owned by the seller. The experiment lets the value $v$ vary from 5 to 95 in increments of 5. First the computer randomly determines $v$ and informs only the seller about $v$. However, the seller evaluates the company only by $qv$, where the seller's commonly known underevaluation parameter $q$ is either 0.25 or 0.55.[11] In each round both, seller and buyer, know whether $q$ is high or low, where both are equally probable. Then the seller, aware of $v$, sends a value message $\hat{v}$ to the buyer which may or may not reveal $v$ to $B$. This value message is only subject to the same integer constraint as for $v$, i.e., the seller freely decides what to report. It is the only information of the buyer with probability $1 - w$. However, and that is the innovation of the paper, with probability $w$ (>0), the buyer also learns the true $v$. The leak probability is either $w$=0.1 or $w$=0.4 and it is randomly selected across rounds. Knowing either only $\hat{v}$ or also $v$, the buyer then proposes a price $p$ between 0 and 60 for the company which the seller can reject or accept. Payoffs are finally calculated and privately communicated to buyer and seller, respectively. In case of acceptance, the buyer earns the difference between the value of the company and the price, i.e., $v - p$, while the seller earns the difference between the price and the own evaluation of the company, i.e., $p - qv$. In case of a rejection, both earn zero.

**Experimental setup.** Our setup allows to assess behavior by:

1. Sellers. How $\hat{v}$ depends on $v$, how acceptance of price proposals $p$ depend on $\hat{v}$ and $v$, and how both seller decisions are affected by the commonly known

[10]The experiment is a parametrized version of the game explained in the previous section.

[11]A low $q$ implies that the seller does not forgo a large payoff in case trade does not occur. In contrast, when $q$ is high, the seller's opportunity cost of not trading is rather high. This difference in evaluating the company can affect the reporting decision when lies are potentially leaked.

parameters $q$ and $w$;

2. Buyers who confront two information conditions, namely:

   (a) one where $v$ and $\hat{v}(v)$ letting the buyer recognize the sign and size of possible misreporting.[12]

   (b) the other where $v$ is not revealed to the buyer and both, seller and buyer, should theoretically behave similar as in the AaC-setup.

**Payoffs.** After the experiment one round was randomly selected. A participant's earnings in this round were converted to probability points for gaining either EUR 4 or EUR 14 in a lottery. This lottery was played out on the participant's computer screen. Obviously such binary lottery incentives induce risk neutrality (see for an early study Roth and Malouf, 1979, and for an often misinterpreted criticism Selten et al., 1999).[13] Subjects earned an average of EUR 8.02 from the binary lottery plus a flat participation fee of EUR 6.

**Implementation.** Due to the constraints imposed by the COVID-19 pandemics, we conducted the experiment in a digital lab-like environment with payments administered immediately after the experiment via Prolific and Paypal.[14] A total of 102 subjects participated in 7 sessions with average length of 105 minutes. The experiment was programmed in OTree (Chen et al., 2016) and carried out between July and October 2020 with the student participants of LUISS Cesare Lab recruited

[12]That actually features deterministic ultimatum subgames with commonly known pie size $(1-q)v$, the surplus from trade.

[13]Specifically, even the lowest payoff does not rule out winning the larger reward, EUR 14, with positive probability and even the highest payoff does not guarantee this with 100 % probability. So even when the buyer exploits the seller by offering $p(v) = qv$ after the $w$ probability event, this would not deprive the seller of all chances to earn EUR 14. Similarly, even the largest possible loss will let the buyer earn the high reward EUR 14 with positive probability. What Selten et al. (1999) show is only that participants do not behave in line with expected utility theory even when rendering them risk neutral.

[14]For a description of the lab-like methodology see Buso et al. (2020).

via ORSEE (Greiner, 2015). Students were from different fields of studies, predominantly from economics, law and political science with an average age of 23.5 and 52 % of them being female. No one participated in more than one session.

**Behavioral considerations.** Due to the leak probability $w$ being positive the LAaC-setup comprises crucially stochastic ultimatum bargaining (see footnote 4 above). Whereas deterministic ultimatum experiments are known for altruistic punishment (i.e. responders reject positive but still unfair offers) and often render equal pie splitting modal, the crucial stochasticity of the AaC-setup essentially crowds out altruistic punishing and rewarding of buyers by sellers (Bazerman and Samuelson, 1983, Samuelson and Bazerman, 1985 and relatedly Angelovski et al., 2020): sellers nearly always accept price offers when this is optimal and reject otherwise.[15]

From a behavioral perspective it is interesting to elicit stochastic and deterministic ultimatum bargaining in one overarching ultimatum experiment confronting participants with both privately and commonly known values $v$, each with positive probability. Do proposers - buyers in LAaC - want to be consistent across both conditions in whether or not to exploit ultimatum power? Or would they refrain from too much exploitation only in case of deterministic ultimatum bargaining, i.e., after the $w$-event.[16] Overreporting sellers, aware of whether the buyer has found out their overreporting, may aim at smaller positive profits for the sake of more likely acceptance when the truth is revealed. Even more crucial, in our view, is whether leaking value information suffices to let some sellers become categorically

[15] Furthermore, "bang-bang" pricing, i.e., buyers offering $p^* = 0$ or $p^* = q$, is hardly ever observed. In AaC-experiments optimal prices $p^* = q$ for $q \leq \frac{1}{2}$ and $p^* = 0$ for $q > \frac{1}{2}$ are not even modal. Güth et al. (2020) confirm the optimal offer as modal but question optimality via the strong intra- and inter-personal heterogeneity of offers.

[16] In the AaC-game (or after the $1 - w$ event in LAaC) optimal ultimatum offers for low q-parameters in the range $q \leq \frac{1}{2}$ are $q$-dependent, $p^* = p^*(q)$, and rather moderate for lower $q$ than $\frac{1}{2}$: only for $q = \frac{1}{2}$ the optimal price $p^* = q$ would let the buyer expect only 0-profits.

truth reporting, possibly due to not wanting to be found out lying. Buyers may indeed believe in sellers' truth reporting and reward them by proposing (nearly) equal surplus sharing prices around

$$p(\hat{v}) = q\hat{v} + (1-q)/2\hat{v} = (1+q)/2\hat{v} \ for \ \hat{v} \in (0,1).$$

Sellers with truth revealing messages should readily accept such $p(\hat{v})$-price offers, at least when $p(\hat{v}) \geq qv$.

Taken together, we want to test the following predictions:

1. *Leak Effects on Reporting (LEOR)*: Information leaks lead to (i) a higher share of truthful reports, (ii) a reduced size of the lies, i.e. $\hat{v}(v) - v$ decreases.

2. *Underreporting (UR)*: Overall, participants are more likely to overreport. However, the share and extent of underreporting, i.e., $\hat{v}(v) - v < 0$, is significant. Underreporting happens especially at high $v$ for fear that the buyer will not believe the true $v$.

3. *Seller Opportunism (SO)*: Sellers accept nearly always when $p > qv$, but mostly reject when $p < qv$. Thus, we expect hardly any altruistic sanctioning or rewarding of buyers by sellers.

4. *Path Dependence (PD)*: Rather than general time trends, we expect path dependence in sellers' misreporting behavior and in buyers' price offering, $p$, but not for acceptance behavior due to *SO*.

5. *Welfare Increase through Leaks (WITL)*: Information leaks increase the likelihood of trade what, in turn, is welfare improving.

# 5 Experimental Results

In this section we analyze the sellers' (mis)reporting behavior and the variables that determine the market outcome such as buyers' price proposals and sellers' decision to accept or reject the proposals. In each case, we first present descriptives before performing regression analyses.

## 5.1 (Mis)reporting behavior

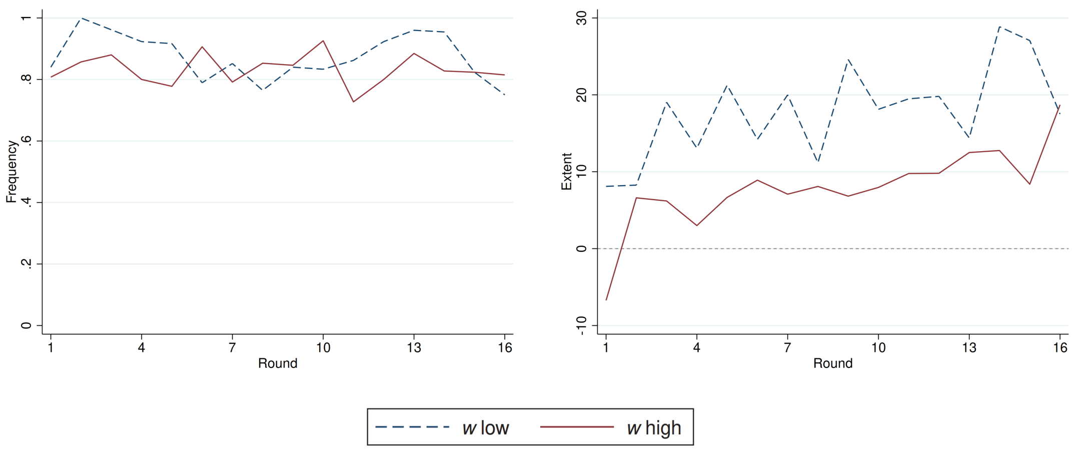
### 5.1.1 Descriptives

**Overview & Dynamics.** Truthful value messages are rare (share 0.145) since most sellers lie and misreport their company's value (share 0.855). The average size of a lie (measured as $\hat{v} - v$) is 12.54 (standard deviation: 27.11).[17]

Figure 2 shows the dynamics. The frequency of misreporting is rather time invariant on a comparably high level and does not depend on the leak probability (left panel). This is somewhat at odds with the prediction *LEOR(i)*. However, the size of sellers' lies increases substantially across rounds (right panel). More interestingly, there is a stable gap in the size of the lies (apart from the very last round): the average difference between the reported and the true value of the company is smaller when the leak probability is high. This is a first piece of evidence for prediction *LEOR(ii)*. In sum, more probable leaks do not lead to fewer dishonest reports, but to less severe ones.

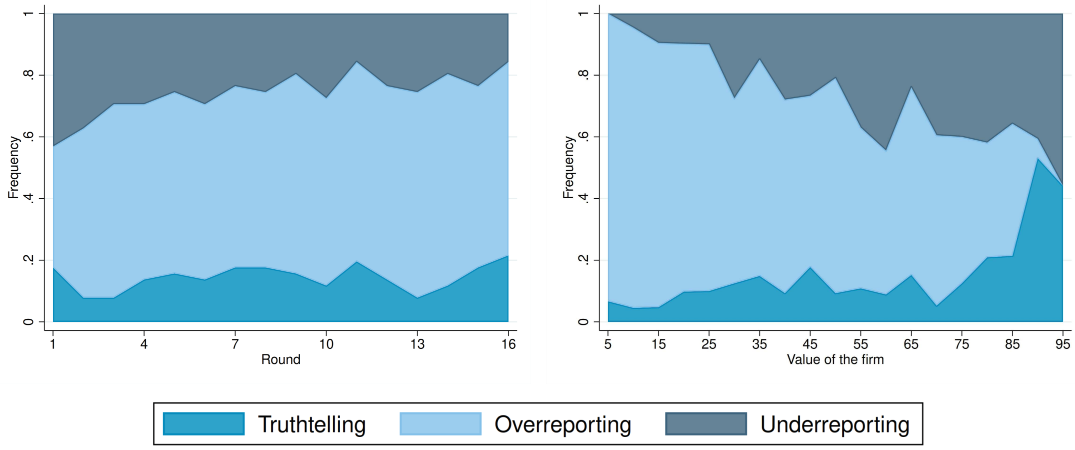
[17] Recall that the value of the company, $v$, varied between 5 and 95 in increments of five.

Figure 2: Dynamics of misreporting behavior: misreporting frequency (left panel) and size of lie (right panel)




Around 70 % (69.82 % to be precise) of all untruthful reports result from sellers overreporting $v$, with a maximum lie of 90. Interestingly, in the case of the remaining almost third (30.18%), the reported value, $\hat{v}$, is lower than the real $v$ with a minimum of -65. Thus, a large number of sellers actually underreport. Figure 3 (left panel) illustrates the frequency and dynamics of under- and overreporting (along with truthtelling) across rounds. Despite the clear and increasing dominance of overreporting, both underreporting and truthtelling still occur to a significant extent in later rounds. Underreporting decreases after the first three rounds, meaning that some participants are learning in which direction it is more convenient to lie.

Figure 3: Truthtelling, over- and underreporting frequencies
by round (left panel) and by company value (right panel)




**Value of the company.** To investigate the reasons behind these different types of misreporting, Figure 3 (right panel) illustrates their dependence on the company value $v$ rather than time. Underreporting and truthtelling increase with value $v$. Overreporting is mostly concentrated at small to medium size values $v$. We summarize our findings which provide evidence for our prediction *UR* in

*Result 1:*

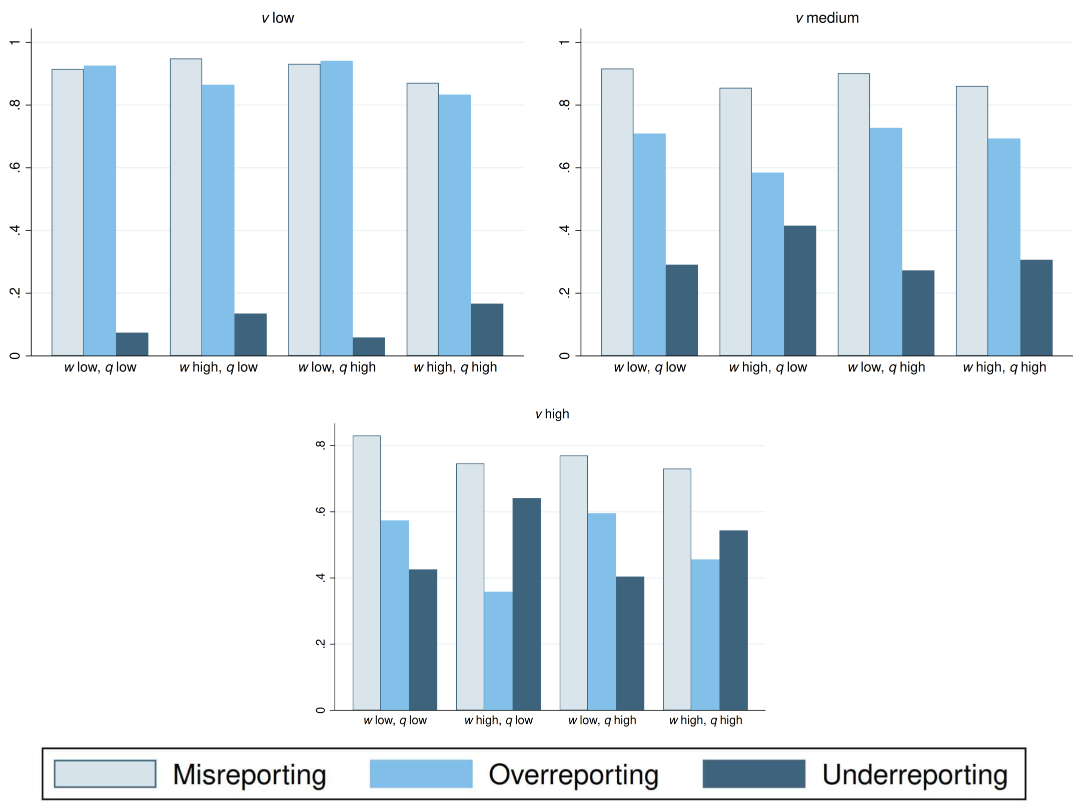
*Misreporting value messages is massive (about 86%) and dominated by nearly 60% overreporting, especially in the lower value range of $v$. However, under- and truthfully reporting are substantial, too.*

**Parameter constellations.** Next we investigate if and how (mis)reporting behavior changes with parameter constellations. In order to take into account the role of the value of the company, we split the distribution of $v$ in three categories: *low* if $v \in \{5, 10, 15, 20, 25, 30\}$, *medium* if $v \in \{35, 40, 45, 50, 55, 60\}$ and *high* if $v \in \{65, 70, 75, 80, 85, 90, 95\}$.

Figure 4 attempts to visualize the joint effects of the parameter constellation for the leak probability, $w$, and the extent of the underevaluation of the company, $q$, as well as of the value of the company, $v$. With respect to the latter, the data corroborates our previous findings: the frequency of underreporting increases as $v$ increases whereas the frequency of overreporting decreases. Surprisingly, the proportion of untruthful versus truthful reports remains rather stable for every combination of parameters, and an increase in $w$ by factor 4 only leads to a small increase of truthful reports. What does change drastically, however, is the structure of the misreports. Subjects seem to substitute overreporting with underreporting, instead of truthtelling. To be more precise, a higher leak probability always leads to a decrease in overreporting and a simultaneous increase in underreporting (compare the first to the second pillars, and the third to the fourth pillars, respectively). Such behavior can be seen as evidence that sellers strive for a positive social image as modest in sharing the pie which only materializes with a high leak probability. They seem to want to achieve this by understating the value of the company and thus enabling the buyer to make a particularly favorable acquisition. The fact that sellers attach a monetary value to their social image is revealed by the fact that they are willing to accept a lower sales price and, thus, payoff, than would have resulted from a value message with the true value of the company. The increase in underreporting for a higher leak probability is stronger, the higher the value $v$. This reveals a second motive for downward lying: the already known danger of scaring off the buyer with honest (and even more so exaggerated) value messages and thus not achieving a trade.

In contrast, the effects for the extent of the underevaluation of the company, $q$, are less pronounced. Only for medium and high values $v$ and a high leak probability, we observe a mild increase in overreporting along a corresponding decrease in underreporting (compare the first to the third pillars, and the second to the fourth pillars, respectively).

Figure 4: Frequency of misreporting and percentage of over and underreporting by parameter constellations




### 5.1.2 Regression Analysis

Our findings from the descriptive data are supported by regression analysis. We apply a three-level, random intercept model with observations nested at the individual and matching group levels. Table 1 shows the results where the dependent variable is the sellers' (mis)reporting extent, i.e. $\hat{v} - v$.

Our set of explanatory variables includes the percentage extent of misreporting in the previous round (measured as the difference between the reported and the real company value relative to the real one), a dummy variable regarding the detection of a lie in the previous round and a dummy variable regarding the acceptance of the proposed price and thus the conclusion of the trade. Furthermore, we use the three-way division of the company value explained above (a medium $v$ is the reference category), and dummy variables for the parameters $q$ and $w$, which are each 1 if the parameter values are high (i.e. 0.55 and 0.4, respectively). We also control for the subjects' risk propensity. The set of controls is complemented by round dummies and demographic controls, which include the gender of the subjects, their age, whether they are studying economics, whether they are experienced in participating in experiments and from which Italian macro-area they come from (i.e. north, center or south of Italy).

Overall, misreporting is path dependent as the extent of a lie in the previous round has some explanatory power. In contrast, whether or not the seller was caught lying in the previous round due to the leak event has no effect on the seller's current misreporting behavior. Interestingly, a seller who had accepted the proposed price previously, is more likely to misreport now. As expected, the value size $v$ plays a predominant role: sellers overreport when $v$ is small, and underreport when $v$ is large. However, this is, at least in part, structural because the range of possible overreporting $\hat{v}$ is small if $v$ is already high, and likewise it is also small for underreporting $\hat{v}$ if $v$ is small. Importantly, and as already revealed by the descriptive statistics, the high leak probability decreases the extent of misreporting. This supports the prediction *LEOR(ii)*. In turn, a higher extent of underevaluation, $q$, increases the extent of misreporting, as sellers anticipate they will have lower profits in this case.

To further explore the role of $w$ model (2) investigates the effect of a 'change in scenario', i.e. whether the leak probability which is randomly determined in every round has increased or decreased (or remained the same), compared to the previous round. Compared to a low $w$ in both rounds, high $w$ discourages misreporting, independently of its value before, while a decrease in $w$ encourages it.

Despite experimentally induced common(ly known) risk neutrality, the post-experimentally self-assessed risk propensity (the higher the value, the more risk loving the subject is) plays a role.[18] More risk loving participants misreport more and the interaction of risk propensity with leak probability in model (3) is weakly significant. This, of course, shows that uncertainty inclinations reflect much more general disposition than narrowly captured by cardinal utility theory and the expected utility hypothesis of expected utility maximization.[19]

[18]It is important to note that the commonly used question for risk assessment, 'Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?' does not mention probabilities or monetary rewards, therefore it is more general than the neoclassical definition of risk aversion.

[19]Note that this questions expected utility theory and not that, according to expected utility theory, binary-lottery incentives induce risk neutrality.

Table 1: Regression analysis of sellers' (mis) reporting

| Depvar: extent of misreporting, $\hat{v} - v$ | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\frac{\hat{v}-v}{v}$ at ( $t-1$ ) | 0.474* | 0.508** | 0.479** |
| | (0.243) | (0.244) | (0.242) |
| Lie detected ( $t-1$ ) | -0.527 | -1.425 | -0.693 |
| | (1.456) | (1.531) | (1.455) |
| Accepted ( $t-1$ ) | 3.762** | 4.006*** | 3.757** |
| | (1.477) | (1.475) | (1.473) |
| Baseline: medium $v$ | | | |
| Low $v$ | 20.023*** | 19.993*** | 19.970*** |
| | (1.498) | (1.493) | (1.494) |
| High $v$ | -17.382*** | -17.387*** | -17.245*** |
| | (1.482) | (1.479) | (1.479) |
| $q$ is high | 4.161*** | 4.028*** | 4.109*** |
| | (1.202) | (1.200) | (1.199) |
| $w$ is high | -9.994*** | | -17.445*** |
| | (1.228) | | (4.147) |
| Baseline: no change in $w$ (low) | | | |
| $w$ was high, now low | | 4.371** | |
| | | (1.844) | |
| $w$ was low, now high | | -7.658*** | |
| | | (1.783) | |
| No change (high) | | -7.291*** | |
| | | (1.888) | |
| Risk propensity | 3.368*** | 3.313*** | 2.763*** |
| | (0.994) | (0.995) | (1.050) |
| Interaction $w$ high $*$risk prop. | | | 1.213* |
| | | | (0.645) |
| Demographics | ✓ | ✓ | ✓ |
| Round dummies | ✓ | ✓ | ✓ |
| Observations | 765 | 765 | 765 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, to complement the analysis on misreporting, Table 6 in Appendix A reports the results of a random-effects multinomial logit regression where reporting behavior is categorized as overreporting, truthtelling and underreporting. Besides confirming what we already observed in Table 1, the estimates corroborate the visual impression of Figure 4. A higher leak probability increases truthtelling, but especially underreporting while, in turn, overreporting decreases. Underreporting and truthtelling are also more frequent for higher company values. Taken together, this may indicate that sellers seem to strive for a positive social image as modest and are eager to increase chances of trade.

We summarize our findings which provide evidence for our predictions *LEOR(ii)*, *UR* and *PD*, in

*Result 2:*

*An increase in the leak probability reduces the size of the lies and changes the structure of misreports with underreporting partially crowding out overreporting. Furthermore, the extent of misreporting is partly path dependent due to inertia in misreporting. In turn, a higher extent of underevaluation, $q$, increases the extent of misreporting.*

## 5.2 Market Outcomes

### 5.2.1 Descriptives

Table 2 reports summary statistics for buyers' behavior in the bargaining process, overall and differentiated according to whether $v$ was private knowledge (upper part $a$) or public knowledge due to an information leak (lower part $a$). In the latter case, we additionally distinguish whether a lie has been detected. Together with average price proposals $p$, we show the implied share of $v$ ($shv$) and the share of surplus

($shs$) stemming from such proposals. In particular, $shs$ is defined as $\frac{v-p}{v}$ when there is an information leak and $v$ is known or $\frac{\hat{v}-p}{\hat{v}}$ when there is no leak. Similarly, the proposed sharing of the surplus, $shs$, is defined as $\frac{v-p}{(1-q)v}$ when there is an information leak and $v$ is known and $\frac{\hat{v}-p}{(1-q)\hat{v}}$ when there is no leak.[20] Proposed prices are slightly smaller when $v$ is leaked ($a$) compared to when there is no information leak ($b$; although the difference is not statistically significant). What is different, however are the requested shares of value. In the first case buyers aim at earning 47 % of the (hypothetical, as they rely on $\hat{v}$) pie size while in the latter when they are informed they lower their requested $shv$ to only 30 %. With such low requests, buyers seem to want to reduce the probability that the seller might reject their price proposal. In addition, the higher share of $\hat{v}$ demanded when $v$ is not known might signal that buyers are anticipating sellers' overreporting tendency.[21]

A distinction based on the type of the lie when $v$ is not leaked (cases *a.1* to *a.3*) and whether or not it was detected in the leak event (cases *b.1* and *b.2*) refines the picture. When $v$ is not leaked, sellers' overreporting and underreporting have, of course, opposite effects on price proposals with the former being significantly higher than the latter. Nonetheless, the requests on $shv$ and $shs$ vary little in the type of the lie. Lastly, in case of leaks, i.e. when there is ultimatum bargaining with complete information like in usual ultimatum games, price proposals are lower when a lie was detected (case *b.1*; 27.46 ) compared to when the seller sent a truthful message (case *b.2*; 32.26). This statistically significant discount (paired t-test on matching group-level averages; p=0.041) could be considered as evidence for buyers discriminating

[20] As the definitions of $shv$ and $shs$ differ depending on whether there was a leak or not, we do not report their averages for the full sample.

[21] A similar picture emerges for the share of the surplus, $shs$, which is either 83 % or 55 %. However, the fact that the requested $shs$ amounts to 83 % when $v$ is not known suggests that participants fail to anticipate the effect of $q$ on the aggregate payoff.

against lying sellers. However, given that sellers are more likely to overreport, overall and more specifically for low $v$-values, it seems much more reasonable to conclude that in this last case buyers simply adapt their pricing behavior to the known $v$. Put differently, there is no evidence that buyers discriminate or punish liars. They rather adapt price proposals to their information set. When only $\hat{v}$ is known, they anchor to this value message and prices are higher because sellers are more likely to overreport. As a matter of fact, when a lie is detected buyers claim a lower share of $v$ (case *b.1* in Table 2) compared to when they are not informed (case *a*). This hints to the fact that they claim more when uninformed because they are anticipating that $\hat{v}$ is overreported. However, the low number of observations does not allow for further robust investigations.

Table 2: Summary statistics of buyers' price and value/surplus sharing proposals

| Buyers' proposals | | | | |
|---|---|---|---|---|
| | $p$ | $shv$ | $shs$ | N |
| All choices | 29.74 | - | - | 816 |
| *a)* $v$ not leaked | 30.29 | 0.47 | 0.83 | 606 |
| *a.1)* overreporting | 32.22 | 0.50 | 0.90 | 358 |
| *a.2)* truthtelling | 33.24 | 0.44 | 0.79 | 88 |
| *a.3)* underreporting | 24.34 | 0.41 | 0.70 | 160 |
| *b)* $v$ leaked | 28.17 | 0.30 | 0.55 | 210 |
| *b.1)* $v$ leaked, lie detected | 27.46 | 0.28 | 0.51 | 179 |
| *b.2)* $v$ leaked, lie not detected | 32.26 | 0.44 | 0.80 | 31 |

*Notes:* $shv$ and $shs$ are defined as the share of value, resp. of surplus the buyer proposes for herself, conditioned on the information she has, i.e. the proposed buyer's payoff over the company value, resp. the total surplus. When $v$ is not leaked, $shv = \frac{\hat{v}-p}{\hat{v}}$ and $shs = \frac{\hat{v}-p}{(1-q)\hat{v}}$; when $v$ is leaked, $shv = \frac{v-p}{v}$ and $shs = \frac{v-p}{(1-q)v}$

Table 3 presents summary statistics for sellers' propensity to accept. In Panel A we report the number of trade opportunities ($N$), the number of acceptance decisions ($\alpha$, i.e. how many of the opportunities turned into realized trades) and the acceptance rate ($\alpha/N$) overall, by information condition depending on whether $v$ was leaked or not, and by $q$-value. In Panel B we report the same quantities distinguishing whether acceptance would imply a positive, null or negative payoff for the seller.

Overall, trade occurs in 75 % of all bargaining situations. However, if $v$ is leaked (case *a.2*), then acceptance occurs significantly more frequent than if $v$ is not leaked (case *a.1*): 80.5 % versus 73.3 % (paired t-test run on acceptance rate at the matching group level, p-value = 0.020). This evidence confirming the key prediction WITL is summarized by

*Result 3:*
*Information leaks increase the probability of trade and, therefore, are welfare improving.*

Furthermore, the acceptance rate is significantly higher when $q$ is low (case *b.1* versus case *b.2*; paired t-test on matching group-level averages; p=0.000). However, this follows somewhat straight from the the seller's payoff structure. The wider the gap in the valuation of the company between the buyer and seller, the wider the range of price proposals that the seller can accept.

When distinguishing choices according to the sign of the potential payoff (Panel B), sellers nearly always accept buyers' price proposals if this yields a positive payoff and reject if negative. This is clearly in line with our prediction *SO* regarding seller opportunism. Quite surprisingly, in nearly 25 % of the cases when acceptance would cause a loss (corresponding to 5.88 % of all observations), sellers accept nevertheless and get a negative profits. Compared to this, sellers rejecting positive profits is more rare (around 8.5 %). This suggests some altruistic rewarding and sanctioning, respectively.[22]

[22] This would somehow contradict hypothesis *SO*. However, the corresponding number of acceptance choices are 48 and 51, respectively, which is too low for reliable behavioral conclusions.

Table 3: Summary statistics of sellers' acceptance, overall (Panel A) and by potential payoff sign (Panel B)

Panel A

| | $N$ | $\alpha$ | *% accepted* ($\alpha/N$) |
|---|---|---|---|
| All choices | 816 | 613 | 75.12% |
| *a.1)* $v$ not leaked | 606 | 444 | 73.27% |
| *a.2)* $v$ leaked | 210 | 169 | 80.48% |
| | | | |
| *b.1)* $q$ is low | 409 | 343 | 83.86% |
| *b.2)* $q$ is high | 407 | 270 | 66.34% |

Panel B

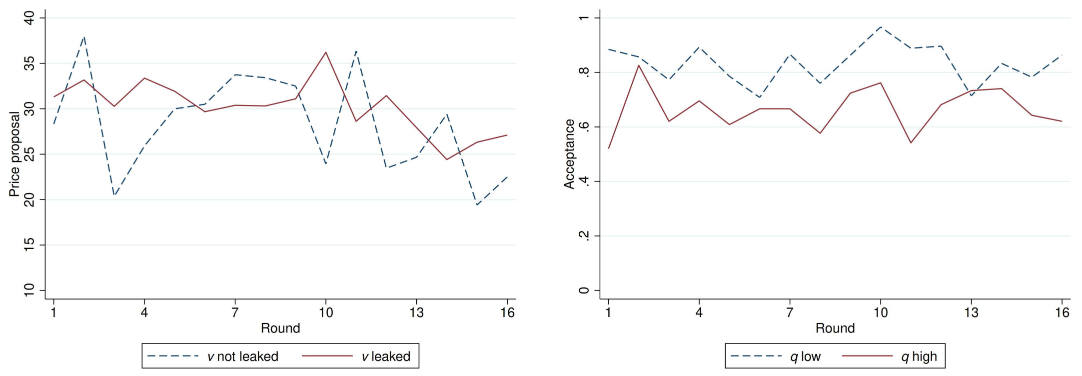
| | $N$ | $\alpha$ | *% accepted* ($\alpha/N$) | *% of sample* ($\alpha/816$) |
|---|---|---|---|---|
| Positive payoffs | 610 | 559 | 91.64% | 68.50 % |
| Null payoffs | 10 | 6 | 60.00% | 0.74% |
| Negative payoffs | 196 | 48 | 24.49% | 5.88% |

*Notes:* $N$ indicates the absolute frequency of cases irrespective of the seller's decision (i.e. the number of potential trade opportunities) while $\alpha$ indicates in how many of those cases the seller accepted (i.e. the number of the realized trades.

Finally, Figure 5 illustrates the price dynamics. When buyers are uninformed ($v$ is not leaked; left panel, dashed line), average prices are more volatile than when $v$ is leaked (solid line), although this may also be due to fewer observations without $v$-leaks. Overall, we see a stable decline of price proposals during the last 6 rounds.

This could be due to late learning of the winner's curse, i.e., of realizing that for large $q$, buyers' expected payoffs from trade are negative. Only for low $q$ their losses would be overcompensated by gains. Despite the declining price offers, acceptance rates are relatively stable at around 75 % over the course of the rounds (right panel). Of course, acceptance rates are higher for low $q$.

Figure 5: Dynamics of buyers' price proposals (left panel)
and sellers' acceptance (right panel)




### 5.2.2 Regression Analysis

Table 4 presents the results of regression analyses with buyers' price proposals, $p$, as dependent variable. We run similar, but not identical, analyses for the split sample based on whether there has been an information leak or not (first two columns) as well as for the full sample (third column). Given that the sample split originates two unbalanced panels with a smaller number of observations than the full one, we resort to random effect regression. To account for matching-group specific effects, all regressions include matching group dummies, as well as round dummies and the set of demographics described in Subsection 5.1.2.

When the buyer is uninformed since $v$ was not leaked, the strong significance of the previous price proposal, $p_{t-1}$, reveals a clear path dependence in pricing behavior. This is a compelling evidence for our prediction $PD$. Interestingly, buyers' price proposals also depend on their experience with sellers' misreporting behavior in the previous round. We categorize misreports as the relative difference between a past value message and the real value. Underreporting result in a negative difference. In contrast, modest overreporting is reflected in a positive difference below 100 % whereas excessive overreporting comes along with a positive difference above 100 %. The reference category is truthful reporting.[23] The analysis reveals that buyers substantially decrease their price offers after having met a seller who overreported compared to having met truthful sellers. So there is inertia in suspicion.

In addition, estimates show that not knowing $v$ let buyers base their decision mostly on the value message received, $\hat{v}$. Obviously, in case of an info leak, it is not $\hat{v}$ but rather $v$ itself which has explanatory power for the price proposals (third column in Table 4). Lastly, the dummy variable *detected*, which is equal to 1 in case $v$ is known and the seller misreported it, turns out to be not significant. Thus, we find no evidence for buyers discriminating against lying sellers. When there is an information leak, buyers rather seem to condition their pricing behavior much more to the real value $v$.[24] We summarize our findings in

*Result 4:*

*When there is no information leak, price offers depend on the message received and own past choice which shows a certain path dependency. When there is an information leak, buyers anchor on $v$ but they do not discriminate against lying*

[23] Since the parameters $q$ and $w$ are highly correlated with lying behavior, we avoid including them in the regression given the presence of the value message and of the lie detection variable.

[24] Across all three specifications, among the demographic controls, females offer significantly higher prices whereas risk propensity turns out insignificant.

*sellers. Furthermore, there is inertia in suspicion, in the sense that interacting with an overreporting seller decreases later price offers.*

Table 4: Panel regression of buyers' proposed price

| | Depvar: price offer, $p_t$ | | |
|---|---|---|---|
| | $v$ not leaked | $v$ leaked | Overall |
| $p_{t-1}$ | 0.252*** | 0.031 | 0.220*** |
| | (0.040) | (0.050) | (0.037) |
| Reporting at $t-1$, baseline: truthtelling | | | |
| Underreporting | 1.244 | -2.869 | 0.935 |
| | (1.321) | (2.087) | ((1.419) |
| Modest overreporting | -1.817 | -4.393** | -1.396 |
| | (1.354) | (1.996) | (1.228) |
| Excessive overreporting | -3.140** | -5.056** | -3.324** |
| | (1.340) | (2.296) | (1.392) |
| $\hat{v}$ | 0.340*** | | 0.322*** |
| | (0.030) | | (0.029) |
| $v$ | | 0.472*** | |
| | | (0.040) | |
| Detected | | -1.637 | -1.515 |
| | | (2.146) | (1.439) |
| Demographics | ✓ | ✓ | ✓ |
| Round dummies | ✓ | ✓ | ✓ |
| Matching group dummies | ✓ | ✓ | ✓ |
| Observations | 564 | 201 | 765 |

*Notes*: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Categories of reporting at $t-1$ correspond to $\frac{\hat{v}-v}{v}$ being either negative (underreporting), null (truthtelling, baseline category), <100% (modest overreporting) or ≥100% (excessive overreporting).

Finally, Table 5 presents the marginal effects of pooled probit regressions with sellers' acceptance as dependent variable. We again show results separately for the cases in which $v$ is (not) leaked (first two columns) and for the full sample (third column). All regressions include round and matching group dummies and the same set of demographic controls. In Panel A we use as regressor the price offer received; in Panel B we include the seller's lie (as percentage of $v$) to check whether own lying behavior affects acceptance.

As predicted, sellers are fully opportunistic (in line with prediction *SO*). The main determinant of acceptance is whether the resulting payoff is at least positive, i.e. whether the proposed price $p$ is larger or at least equal to the seller's valuation of the company, $qv$. With the exception of an info leak, the price level itself also has a significant, albeit small, effect. Massively overreporting also enhances acceptance, compared to truthtelling, and actually triggers higher and thereby more acceptable price offers. But this phenomenon disappears when restricting the analysis to cases when informed buyers offer prices. Moreover, sellers do not discriminate against buyers who they have found out lying about the company's value. However, the coefficient measuring whether a lie was detected is small and insignificant.

Table 5: Panel regression of sellers' acceptance

| Depvar: acceptance decision | | | |
|---|---|---|---|
| **Panel A** | | | |
| | $v$ not leaked | $v$ leaked | Overall |
| Non-negative payoff | 0.382*** | 0.373*** | 0.366*** |
| | (0.019) | (0.040) | (0.020) |
| $p_t$ | 0.004*** | 0.002 | 0.004*** |
| | (0.001) | (0.002) | (0.001) |
| Detected | | -0.015 | 0.022 |
| | | (0.085) | (0.027) |
| **Panel B** | | | |
| | $v$ not leaked | $v$ leaked | Overall |
| Non-negative payoff | 0.402*** | 0.443*** | 0.405*** |
| | (0.016) | (0.037) | (0.018) |
| Reporting at $t$, baseline: truthtelling | | | |
| Underreporting | -0.012 | 0.081 | 0.002 |
| | (0.039) | (0.066) | (0.039) |
| Modest overreporting | -0.033 | -0.069 | -0.040 |
| | (0.039) | (0.070) | (0.041) |
| Excessive overreporting | 0.093** | -0.090 | 0.034 |
| | (0.040) | (0.077) | (0.039) |
| Demographics | ✓ | ✓ | ✓ |
| Round dummies | ✓ | ✓ | ✓ |
| Matching group dummies | ✓ | ✓ | ✓ |
| Observations | 606 | 185 | 816 |

*Notes*: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Categories of reporting at $t$ correspond to $\frac{\hat{v}-v}{v}$ being either negative (underreporting), null (truthtelling, baseline category), <100% (modest overreporting) or ≥100% (excessive overreporting).

We summarize these insights in

<u>*Result 5*</u>*:*

*Sellers are fully opportunistic. They make their acceptance decision dependent on* *whether the resulting payoff is positive.*

## 6 Conclusion

Laboratory experiments exploring (im)moral behavior partly suffer from implicit and explicit demand effects. We tried to weaken this not only by employing a market setup, but also render the demand effect for lying ambiguous: although sellers might try to trigger higher price offers via exaggerating value-messages, they should be discouraged by leaking information. In this way, information leaks modify the Acquiring-a-Company setup: by default, there is asymmetric value information of the seller who, as studied before, can send a true or false value message. This we have enriched by including a commonly anticipated probabilistic leak-event whose probability is either 10 % or 40 %.[25] Via info leaks also the buyer can know the true company value. Thus, the buyer can identify an untrue value message as a lie and also determine its extent and sign before proposing a price which the seller may finally reject or accept. Only in the latter case, trade occurs.

Increasing the leak probability surprisingly only mildly increases truth telling. Instead, it reduces the size of the lies and changes the structure of misreporting where the incentives for deviations from the truth are twofold. On the one hand, sellers frequently overstate the value of their company in order to induce higher price proposals and, thus, boost payoffs. We refer to this as overreporting. However, overreporting accounts only for roughly two thirds of all misreporting and decreases when the leak probability increases. On the other hand, there is also underreporting

[25]More generally, commonly anticipated "leak" events allow for continuous classes of hybrid games, in our case including the deterministic border cases where the leak probability is either 1 or 0. See also Fischer et al. (2021), who theoretically analyze leaks in sequential auctions.

possibly due to hoping that it increases the probability of trade. Underreporting increases when the informations leaks are more likely. Price proposals of buyers unaware of the true value of the company are based on the value message and show a certain path dependency. In contrast, those buyers who found out value misreporting, anchor on the true value. Thus, they do not care too much when having found out value misreporting and abstain from discriminating against liars. However, they do exhibit a certain inertia in suspicion: having interacted with an overreporting seller makes them decrease their price offers in future rounds. Sellers are fully opportunistic with the non-negative sign of the potential payoff being the main driver of their acceptance decision. Thus, morality concerns in this market exchange do not seem to matter much.

Altogether our data indicate a strong trade and welfare enhancing effect of probabilistic leaks, not only when welfare enhancing trade is (game) theoretically unpredicted in case of zero-leak probability, but also when it is predicted to occur with 100 % probability.

The high average acceptance rate of nearly 80 % shows that from the policy perspective info leaks, e.g. due to whistle blowing, are trade and welfare enhancing, even when its probability is low. Thus, creating such information leaks should be encouraged.[26] In our view, incentivizing whistle blowing would help (law) relevance. Nevertheless dealing with private information will always prevail and cannot be neglected. There will be credence goods, insiders on financial markets, hidden information of agents in corporate business, etc. So investigating whereas information leaks may limit exploitation of uninformed by privately better informed parties in market interaction will remain important, irrespective whether whistle blowing is legally and socially

[26] In experimental research incentivizing whistle blowing has been studied via Prisoner's Dilemma experiments which incentivize unilateral defection from mutual cooperation.

encouraged. This is where our paper tries to add to the literature.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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# Appendix A

Table 6: Coefficients from random-effects multinomial logit regression with reporting as categorical dependent variable: *overreporting* (baseline), *truthtelling* and *underreporting*

| Depvar: reporting at round $t$ | | |
|---|---|---|
| | *Truthtelling* | *Underreporting* |
| Reporting at $t-1$, baseline: overreporting | | |
| Truthtelling $t-1$ | 0.430 | 0.383 |
| | (0.373) | (0.431) |
| Underreporting $t-1$ | 0.476 | 1.552*** |
| | (0.401) | (0.367) |
| Lie detected ( $t-1$ ) | -0.231 | -0.436 |
| | (0.343) | (0.345) |
| Accepted ( $t-1$ ) | 0.120 | -0.325 |
| | (0.337) | (0.320) |
| Baseline: medium $v$ | | |
| Low $v$ | -1.385*** | -2.608*** |
| | (0.394) | (0.408) |
| High $v$ | 1.841*** | 2.036*** |
| | (0.325) | (0.336) |
| $q$ is high | -0.054 | -0.727** |
| | (0.269) | (0.273) |
| $w$ is high | 1.146*** | 1.453*** |
| | (0.284) | (0.291) |
| Demographics | ✓ | |
| Round dummies | ✓ | |
| Matching group dummies | ✓ | |
| Observations | 765 | |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

# Appendix B

## English translation of the Italian instructions

Welcome to this experiment!

During this fully computerized experiment, you and the other participants will have to make some decisions. Your decisions and those of the other participants will determine your earnings for the experiment, which will be calculated as explained below. During the experiment, you will repeatedly make choices that will be described shortly.

At the end of the experiment one of the rounds will be randomly selected for payment.

PLEASE NOTE: for each decision you have to make you will have a maximum time of one minute. If you do not make your decision in time, the computer will select for you a random choice from among the possible ones and, in some cases described below, you will receive a penalty. On your screen at the top right you will find a clock that will show you how much time you have left to make your decision.

### Your earnings for the experiment

To participate in the experiment, and to answer the questions in the short questionnaire that will follow immediately at the end of it, you will receive a participation fee of 6 euros. In addition to the participation fee, you can earn alternatively 4 or 14 euros depending on your behavior, that of the other participants and luck.

Your earnings for the entire experiment will be paid to you at the end of the experiment. No other participant besides you will be informed by us about how much you have earned.

All the amounts reported in the experiment are expressed in ECU (experimental currency unit). At the end of the experiment, the ECUs you have accumulated will be converted into the probability of earning 4 or 14 euros as will be explained below. Enjoy!

### Description of the experiment

In this experiment, a seller owns a company that has a certain value for a buyer, who wants to buy it. At the beginning of the experiment, the computer will randomly assign to each of you the role of Seller or Buyer and it will be maintained for the whole length of the experiment. The experiment consists of 16 rounds. At the beginning of each round, the computer will randomly form pairs composed of a Seller and a Buyer. At the beginning of each round, therefore, you will be paired casually with a Buyer if you are a Seller or with a Seller if you are a Buyer. The computer will randomly select in each round the company's true value $v$ from a set of integer values (5,10,15,20,25,30,35,40,45,50,55,60,65,70,75, 80,85,90 and 95) all equally probable, and will communicate it only to the Seller. Note that the value $v$ measures how much the company is worth for the buyer, while for the seller it is worth less, i.e. a value equal to $qv$, where $q$ represents a depreciation coefficient of the company for the seller which is between zero and one.

NOTE: at the beginning of each round, the coefficient q will be randomly selected from the computer between two possible values (0.25 or 0.55) and will be communicated to both Seller and Buyer.

The Seller, after knowing the value of the company extracted from computer V, must send the buyer, via the computer, a message concerning the value of the company. The message sent can be the same or different from the actually extracted V, but it must always be one of the integer values that$v$can assume (5,10,15,20,25,30,35,40,45,50, 55.60.65.70.75.80.85.90 and 95).

The Buyer in turn can find out if the value of the company communicated to him by the Seller corresponds to the true value extracted from the computer with a probability equal to w, while with probability 1-w he does not know if the value communicated to him by the Seller is the real one. The probability w that the buyer learns the value extracted for the company may alternatively be 10% or 40%. The computer will randomly select one of two possible values at the beginning of each round and communicate it to both the Buyer and the Seller. NOTE: the Seller will be informed whether or not the Buyer has become aware of the real value of the company.

Regardless of whether he only knows the message sent by the Seller or also the$v$value actually extracted, the Buyer, must propose a price p to purchase the company between 0 and 60. The Seller can accept or reject the price proposed by the Buyer for the purchase of the company, and consequently sell the company or not. The earnings of each choice will be explained later.

**If you are a SELLER**

If you are a Seller, you own the company and evaluate it by reducing its$v$value by a percentage, q, which may be equal to 0.25 or 0.55. This percentage will be extracted at the beginning of each round from the computer and will be communicated both to you and to the Buyer paired with you randomly in each round.

Once informed about V, you must send a message concerning the value of the company to the Buyer, knowing the probability that (s)he ends up being informed of the true extracted value V. This probability will alternatively be 10% or 40%; consequently, the probability that (s)he is not informed will be respectively 90% or 60%. The computer will randomly select at the beginning of each round if this probability will be 10% or 40% and will communicate it to you and the Buyer associated with you randomly.

The message on the value of the company that you send to the Buyer includes all the possible values that $v$ can assume, including its true value. NOTE: You will always be informed if the Buyer has become aware of the true value of the company. Whatever the Buyer knows, he will then have to propose a price for the purchase of the company between 0 and 60. Once this price is known you will have the opportunity to accept and sell the company, gaining p-qV, or to reject. In case of rejection, both you and the Buyer earn 0.

PAY ATTENTION: for each decision you have to make you will have a maximum time of one minute.

- If you do not communicate your message in time, the computer will communicate a random value among those possible. In addition, if a round in which you have not communicated the value on time is drawn for the final payment, a 5% penalty will be applied to your probability of winning the high prize in the final lottery.
- If you don't communicate your acceptance or rejection decision in time, the computer will randomly choose for you. In this case no penalty is applied.

On your screen at the top right you will find a clock that will show you how much time you still have to make your decision.

**If you are a BUYER**

If you are a Buyer, you will receive a message from the Seller, $\hat{v}$, on the value of the company you want to buy. This message can be equal to one of the following values (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90 and 95) and can be equal or different from the true value of the company extracted from the computer and communicated to the Seller with which you are randomly paired at the beginning of each round.

With a positive probability equal to w, you will also be informed of the company's true value $v$ extracted from the computer, which can take one of the following values (5,10,15,20,25,30,35,40,45,50,55, 60, 65, 70, 75, 80, 85, 90 and 95); with the complementary probability 1-w, on the other hand, you will not be aware of V. The computer will randomly select at the beginning of each round if this probability will be 10% or 40% and will communicate it to you and to the Seller paired with you.

Regardless of whether you know $\hat{v}$ and V, or only $\hat{v}$, you will have to offer a price, p, in the range between 0 and 60, to which you are willing to buy the company.

Remember that $v$ represents the value that you attribute to the company, while the Seller evaluates it to qV.

PAY ATTENTION: you have one minute to choose the price to offer. If you don't communicate the price on time, the computer will communicate a random price among the possible ones. In addition, if a round in which you have not communicated the price on time is drawn for the final payment, a 5% penalty will be applied to your probability of winning the high prize in the final lottery.

On your screen at the top right you will find a clock that will show you how much time you still have to make your decision.

Once the price you offer is communicated, the Seller can accept this price and sell the company or reject it and keep it for himself. If you buy the company at the offered price you will earn the true value of it minus the accepted price (V-p). If your offer is rejected, there will be no transaction and both you and the Seller earn 0.

**Final payment for the experiment**

At the end of the experiment, the computer will randomly select one round for payment. Your gain in each round of the experiment is calculated as follows.

If the seller has accepted the buyer's offer (price):

- the Buyer earns in ECU the difference between the actual value of the company and the accepted price, i.e. V-p;
- the Seller earns in ECU the difference between the accepted price and its evaluation for the company, i.e. p-qV.

If the seller has rejected the buyer's offer (price):

- no exchange occurs: the gain in ECU is zero for both.

This gain will then be converted from ECU to EURO in the following way.

Suppose that the ECUs you earned in the round drawn for the payment is equal to G. You will receive 4 or 14 euros in addition to the participation fee of 6 euros based on G and luck.

In particular, your probability of earning 14 euros will be given by:

$$\left[(60+G)\cdot\tfrac{100}{160}\right]\%$$

And the probability of earning 4 euros will be given by:

$$100\% - \left[(60+G)\cdot\tfrac{100}{160}\right]\%$$

Note that the higher G, the higher your chance of winning 14 euros, even if there is always some probability of winning 4 euros and vice versa.

For example with G = 0 your probability of earning 14 euros is still positive and equal to

$$\left[60\cdot\tfrac{100}{160}\right]\% = 37.5\%$$

While the probability of earning 4 euros is equal to

$$100\% - \left[60 \cdot \tfrac{100}{160}\right]\% = 62.5\%$$

Alternatively, with G=90 you can earn 4 euros with probability:

$$100\% - \left[150 \cdot \tfrac{100}{160}\right]\% = 6.25\%$$

and 14 euros with the complementary probability, i.e. 93.750%.

NOTE: the probability of winning €14 is reduced by 5% if the round selected for payment is one in which you have not made your choices in time, in particular the value to be communicated for the Sellers and the price to be proposed for the Buyers.

Once the computer calculates and communicates your probability of earning 4 or 14 euros, a fortune wheel will appear on your screen, the result of which will determine whether you will earn 4 or 14 euros, in addition to your participation fee of 6 euros.

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