JENA ECONOMIC RESEARCH PAPERS

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Compulsory Disclosure of Private Information

Theoretical and Experimental Results for the "Acquiring-a-Company" Game

Werner Güth[*], Kerstin Pull[♭], Manfred Stadler[♮], and Alexandra Zaby[♯]

Abstract

Based on the "acquiring-a-company" game of Samuelson and Bazerman (1985), we theoretically and experimentally analyze the acquisition of a firm. Thereby we compare cases of symmetrically and asymmetrically informed buyers and sellers. This setting allows us to predict and test the effects of information disclosure as prescribed by two recently implemented directives of the European Union, the Transparency and the Takeover-Bid Directive. Our theoretical and experimental results suggest a welfare-enhancing effect of compulsory information disclosure. Hence, the EU Transparency and the EU Takeover-Bid Directive should both be welfare enhancing.

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1. Introduction

It is well known that insider information might preclude trade (see, e.g., Akerlof, 1970) and reduce welfare. One institutional measure to prevent this is the compulsory disclosure of private information, i.e., legally forcing the informed party to reveal its superior information. Mergers and acquisitions are a main focus in this respect since asymmetric information may prevent desirable takeovers.

In the European Union, two central directives are related to the acquisition of firms: The *Transparency Directive*[1] and the *Takeover-Bid Directive*[2]. The main intention of the Transparency Directive is to improve investor protection and market confidence. Its aim is to simplify access to corporate information across EU member states, discourage secret stock building in listed companies, and reduce legal uncertainty.[3] The goal of this directive is therefore to mitigate the problem of asymmetric information for buyers/investors.

The Takeover-Bid Directive, to the contrary, improves the information rights of potential *sellers* of a firm, e.g., its shareholders. It requires that "*a decision to make a [takeover] bid is made public without delay*"[4]. Furthermore "*an offerer is required to draw up and make public in good time an offer document containing the information necessary to enable the holders of the offeree company's securities to reach a properly informed decision on the bid.*"[5] Hence, potential investors intending to acquire a firm have to publicly place their takeover bid and disclose further information in the offer document.

Although the intention of these legal measures is clearly to reduce or avoid asymmetric information by compulsory disclosure either on the seller or buyer side, it will depend on the market environment whether these measures actually enhance welfare. In this paper we theoretically and experimentally explore the effects of compulsory disclosure of information by using the "acquiring-a-company" game. Extending the scenario discussed by Samuelson and Bazerman (1985), we distinguish two settings with asymmetric information, namely

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[1] Directive 2004/109/EC on the harmonisation of transparency requirements in relation to information about issuers whose securities are admitted to trading on a regulated market.

[2] Directive 2004/25/EC on takeover bids.

[3] This is achieved by "*establishing requirements in relation to the disclosure of periodic and ongoing information about issuers whose securities are already admitted to trading on a regulated market*" (see Directive 2004/109/EC, §1.)

[4] Directive 2004/25/EC, §6(1).

[5] Directive 2004/25/EC, §6(2).

- one with only the seller and

- one with only the buyer

knowing the value of the firm. Since we are interested in the effects of compulsory information disclosure, we analyze the effect of a *transition* from each of the two asymmetric information cases to a setting where both parties are informed about the firm's value. To the contrary, previous experimental studies on the "acquiring-a-company" game focused on one specific setting in isolation (e.g., where the seller is better informed, see Ball et al., 1991, Selten et al., 2005, Foreman and Murnighan, 1996, Dittrich et al., 2012, Grosskopf et al., 2007) and not on the transition from asymmetric to symmetric information.

The remainder of the paper is organized as follows. Section 2 introduces the possible institutional settings together with their game theoretic benchmark solutions and welfare implications. The hypotheses to be tested experimentally are stated in Section 3. Section 4 describes the experimental design. Experimental results are illustrated and statistically analyzed in Section 5. Section 6 concludes.

2. The "acquiring-a-company" game

This game involves a (potential) seller S and a (potential) buyer B. The seller owns a company he evaluates by qv, where $q \in (0, 1)$ is an exogenously given and commonly known parameter and $v \in (0, 1)$ is the value of the company for the buyer to whom he wants to sell the company. Thus the evaluations of the firm are perfectly and linearly correlated, and due to $q < 1$ trade is welfare enhancing. If p denotes the price for selling the company to B, the gains from trade are $v - p$ for B and $p - qv$ for S such that the surplus amounts to $(1 - q)v$. We assume throughout that v is randomly distributed according to the uniform density on the support [0, 1] and that there is common (knowledge of) risk neutrality. Samuelson and Bazerman (1985) assume that only S is aware of v and that

(i) buyer B proposes a price $p \in [0, q]$ that

(ii) seller S can accept $(\delta(p) = 1)$ or reject $(\delta(p) = 0)$, the latter resulting in zero payoffs for both parties. Altogether the payoff is $\delta(p)(v - p)$ for B, and $\delta(p)(p - qv)$ for S.

Theoretically one can distinguish four different information structures where the baseline scenario assumes no information at all about the realization of v.

Scenario (NN): Neither buyer nor seller know the realization of v.

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Since v is uniformly distributed on the unit interval, the seller's expected payoff in case of $\delta(p) = 1$ is

$$E\pi_S(p) = p - q/2$$

so that S would accept ($\delta^*(p) = 1$) only if $p \geq q/2$. Since the buyer expects

$$E\pi_B(p) = 1/2 - p$$

from trade, the optimal price offer of B is $p^{NN} = q/2$. S will accept this offer, leading to trade. The expected payoffs for buyer and seller are

$$E\pi_B^{NN} = (1 - q)/2 \quad \text{and} \quad E\pi_S^{NN} = 0 \,. \tag{1}$$

Buyer B exploits ultimatum power and acquires the total expected surplus $(1 - q)/2$ from trade.

The information structure analyzed by Samuelson and Bazerman (1985) is

Scenario NI: Whereas seller S is perfectly informed about the realization of v, it is commonly known that buyer B only knows the distribution of v.

Clearly, $\delta^*(p) = 1$ is optimal only if $p/q \geq v > 0$. The buyer's expected payoff thus depends on the chosen price p according to

$$E\pi_B = \int_0^{p/q} (v - p) \, dv = \frac{(1 - 2q)p^2}{2q^2} \,.$$

In case of $q \leq 1/2$, the optimal price offer by the buyer is $p^{NI} = q$, and the expected payoffs for the buyer and the seller are

$$E\pi_B^{NI} = (1 - 2q)/2 \,, \quad E\pi_S^{NI} = q/2 \,. \tag{2.1}$$

These results imply welfare-enhancing trade as in Scenario **NN** but now with more balanced gains from trade.

In case of $q > 1/2$, however, $E\pi_B < 0$ for $p > 0$ so that the optimal price offer of B is $p^{NI} = 0$. Similar to the lemon problem as studied by Akerlof (1970), there will be no trade due to adverse selection, and the (expected) payoffs are

$$E\pi_B^{SB} = 0 \,, \quad E\pi_S^{SB} = 0 \,. \tag{2.2}$$

$$\tag{2}$$

In the third

Scenario IN it is commonly known that only the buyer is aware of the realization of v while the seller only knows the distribution of v. Thus the interaction becomes

a signaling game since buyer B may or may not reveal his information about v by his price offer $p(v)$ to the seller. The seller obviously expects the price to be below the value, i.e., $p < v$. Therefore the expected payoff for the seller is

$$E\pi_S = \int_p^1 (p - qv)dv = p - \frac{q}{2} - (1 - \frac{q}{2})p^2 .$$

Due to $q < 1$, this payoff function is concave in p and positive in the interval $p \in (\frac{q}{2-q}, 1)$, rendering $p^{IN} = \frac{q}{2-q}$ the buyer's optimal price offer. The expected payoffs for buyer and seller are

$$E\pi_B^{IN} = \int_{q/(2-q)}^1 (v - q/(2-q))dv = \frac{2(1-q)^2}{(2-q)^2} , \quad E\pi_S^{IN} = 0 , \tag{3}$$

so that the expected payoff for B is lower than in scenario **NN** for all $q > 0$, due to trade being restricted to $v \geq p^{IN} = q/(2-q) > 0$. Thus the solution is partly v-revealing in that from observing $p = 0$ the seller can conclude that $v < p^{IN}$, whereas from observing $p = p^{IN}$ he infers that $v \geq p^{IN}$, i.e., whether trade is excluded may depend on the v-range.

In the fourth

Scenario II both, buyer and seller, are known to be informed about the realization of v.

The buyer again exploits ultimatum power by offering $p^{II} = qv$. This leads to the expected payoffs

$$E\pi_B^{II} = (1 - q)/2 , \quad E\pi_S^{II} = 0 , \tag{4}$$

which coincide with those in scenario **NN**. The same expected payoffs, however, rely on a crucial difference in that seller S earns nothing for all $v \in (0, 1)$ in scenario II, whereas in scenario NN his payoff $q(1/2 - v)$ is v-dependent and specifically negative for $v > 1/2$.

The results of all scenarios are summarized in table 1: The seller is ex ante best off when privately informed about v, i.e., if he has exclusive information. Otherwise, his expected payoff is zero. The buyer is best off when both players are either informed or uninformed about v.

		Seller is informed about v	
		no	yes
Buyer is informed	no	$\left(p^{NN}, E\pi_B^{NN}, E\pi_S^{NN}\right) =$ $\left(\frac{q}{2}, \frac{1-q}{2}, 0\right)$	$\left(p^{NI}, E\pi_B^{NI}, E\pi_S^{NI}\right) =$ $(0, 0, 0)$ for $q > \frac{1}{2}$ $\left(q, \frac{1-2q}{2}, \frac{q}{2}\right)$ for $q \le \frac{1}{2}$
about v	yes	$\left(p^{IN}, E\pi_B^{IN}, E\pi_S^{IN}\right) =$ $\left(\frac{q}{2-q}, \frac{2(1-q)^2}{(2-q)^2}, 0\right)$	$\left(p^{II}(v), E\pi_B^{II}, E\pi_S^{II}\right) =$ $\left(qv, \frac{1-q}{2}, 0\right)$

Table 1: Benchmark solutions regarding prices and payoffs for B and S

3. Compulsory disclosure of information

Compulsory disclosure as prescribed by the Transparency Directive and the Takeover-Bid Directive can be captured by a transition from scenario **IN** or **NI**, respectively, with asymmetric information to information structure **II**, where the value of the firm, v, is common knowledge. Table 2 shows the theoretical implementation of the institutional changes envisaged by the directives.

	Takeover-Bid Directive	Transparency Directive
Asymmetric information	only buyer knows v (IN)	only seller knows v (NI)
$\downarrow$	$\downarrow$	$\downarrow$
Symmetric information	both know v (II)	both know v (II)

Table 2: Institutional changes envisaged by the EU Directives

The EU Transparency Directive aims to improve access to information for potential buyers of a firm. In our model this is captured by the change from scenario **NI** to **II**. Since the sum of payoffs comprises the gains from trade, we conclude that this change in information is welfare enhancing in case of $q > 1/2$ and leads to[6]

Hypothesis 1. *Eliminating asymmetric information for the potential buyer is welfare enhancing only in case of $q > 1/2$.*

The EU Takeover-Bid Directive intends to reduce asymmetric information for the seller, an institutional change captured by a transition from scenario **IN** to **II**. Comparing the sum of expected payoffs in both scenarios shows that this change in information is welfare enhancing. Thus we state

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[6]Note that in all our analyzes we abstract from the costs of information acquisition.

Hypothesis 2. *Eliminating asymmetric information for the seller is welfare enhancing.*

Although there is no effect of the EU Transparency Directive on welfare for $q \leq 1/2$, the benchmark proposes that the elimination of asymmetric information affects the payoffs of buyer and seller: while the buyer's payoff increases for all values of q, the seller's payoff decreases for low values $q \leq 1/2$. This leads to

Hypothesis 3. *Eliminating asymmetric information for the potential buyer for all values of q increases the payoff for the buyer but decreases the payoff for the seller for low values $q \leq 1/2$ only.*

To the contrary, for the EU Takeover-Bid Directive the benchmark proposes that the newly informed seller does not gain from compulsory disclosure, whereas the buyer's payoff increases. This leads to our final hypothesis.

Hypothesis 4. *Eliminating asymmetric information for the potential seller increases the payoff for the buyer, while the payoff for the seller is left unchanged.*

Altogether, as a response to the EU directives compulsory disclosure leads to welfare gains, at least in case of $q > 1/2$. For both directives we further find that the buyer gains from compulsory disclosure, whereas the seller possibly loses.

4. Experimental design and setup

The experimental treatments describe the institutional transitions from either one of the scenarios with one-sided information, **NI** or **IN**, to scenario **II**, where both, seller and buyer, are informed about the value of the firm (see table 2), implemented in a within-subjects design.[7] In treatment TBD (Takeover-Bid Directive) we consider the change from scenario **IN** to scenario **II**, whereas in treatment TD (Transparency Directive) we implement the transition from scenario **NI** to scenario **II**.

The subjects are either in role B, a potential buyer, or in role S, a potential seller. Participants were randomly assigned one of the two roles and remained in that role throughout the experiment.

In treatment TBD, participants first played three rounds of the **IN** game (phase 1), followed by three rounds of the **II** game (phase 2). In treatment TD, participants

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[7]For the analysis of the transition from scenario NN, where buyer and seller are uninformed, to scenario II, refer to Güth et al. (2013).

first played three rounds of the **NI** game (phase 1), followed by three rounds of the **II** game (phase 2). Thus in both treatments, TBD and TD, participants played the "acquiring-a-company" game for a total of six rounds, three rounds each in phase 1 and phase 2.

In each of the three rounds, participants were confronted with one of three possible q-values, $q \in \{0.35, 0.45, 0.55\}$. The informed party, i.e., B-participants in the **IN** game, S-participants in the **NI** game, and both, B- and S-participants, in the **II** game, were subsequently confronted with 15 randomly drawn realizations of v. These realizations, including their order of appearance as well as the order of the three q-values, were drawn before the experiment and held constant over all treatments and sessions. In phase 1 the informed side of the market had to state a price for every v: informed B-participants (scenario **IN**) had to state the buying price BP they would be willing to pay to acquire the company and informed S-participants (scenario **NI**) had to state the selling price SP at which they would be willing to sell the company. In phase 2 (scenario **II**) both were informed about the value of v and had to state a price for every one of the 15 random v-values. Hence, in the **IN** game B-participants had to make 45 decisions, in the **NI** game S-participants had to make 45 decisions, and in the **II** game both, B- and S-participants, had to make 45 decisions. The uninformed party in phase 1, however, could only state one price in every round, knowing only the distribution of $v \in$ [0, 100] but not its realized value.

The price choices of participants reflected their respective acceptance thresholds for trade to take place: S-participants' price offers SP reflected the minimum price at which they would be willing to sell the company, while B-participants' price offers BP corresponded to the maximum price they would be willing to pay to acquire the company. If the price offered by a potential buyer exceeded the price choice of a potential seller, the company was sold at the offered price, otherwise no trade took place. The resulting payoffs, $(v - p)$ for buyers and $(p - qv)$ for sellers, were specified formally as well as verbally in the instructions to be found in the Appendix. There was no feedback between rounds. At the end of the experiment, each B-participant was randomly matched with an S-participant, and for each round one realization of v was randomly chosen for payment, i.e., participants were paid for six decisions altogether.

All sessions started with a set of control questions clarifying and testing whether the decision tasks and the calculation of payoffs were fully understood by the participants. To emphasize that negative payoffs were possible, an appropriate example

was included in the control questions. After all participants had answered all control questions correctly, three trial rounds, including feedback to participants, took place to ensure they understood the consequences of their decisions.

After completion of phases 1 and 2 of the experiment, participants were asked to fill out a postexperimental questionnaire designed to collect demographic information and elicit participants' risk tolerance (see Holt and Laury, 2002).

Throughout the experiment, payoffs were calculated in Experimental Currency Units (ECU) and converted into euros at a given exchange rate (6 ECU = 1 euro) at the end of the experiment. Besides a show-up fee of 5 euros, participants received their payoff earned by 6 randomly drawn decisions (one for each of the six rounds) as well as the reward for one question in the postexperimental questionnaire (concerning risk tolerance). The experiment was programmed in z-tree (see Fischbacher, 2007). We ran 3 sessions with 32 participants each for each treatment. Participants were students of Friedrich Schiller University Jena (Germany). On average, one session lasted about 90 minutes, and the average payment of participants amounted to 16.36 euros including the show-up fee and the reward for the lottery question. Earnings ranged from 5.10 to 47.30 euros.

When payoffs (not including the show-up fee and the reward for the lottery question) summed up to a negative value, participants had the choice to either pay their debt out of pocket or to work it off by completing an effort task (i.e., counting the letter "t" in a text).[8] All 8 (8.3%) participants confronted with negative payoffs chose to work off their debt.

5. Experimental results

We start with a short description of the results concerning phase 1 in both treatments, i.e., either only the seller is informed about the value of the firm (phase 1 in TD) or only the buyer is informed (phase 1 in TBD).

In phase 1 of treatment TD, the informed sellers set a price acceptance level for every of the 15 randomly drawn v-values (SP), while participants in the role of buyers choose only one price (BP) in every round. Figure 1 depicts the mean choices of BP and SP in the three rounds of phase 1.

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[8]For every completed extra exercise participants could work off 5 euros. As the negative payoff could not be compensated by the show-up fee and the reward for the lottery question in the postexperimental questionnaire, participants who chose to work received a positive payoff in the end.
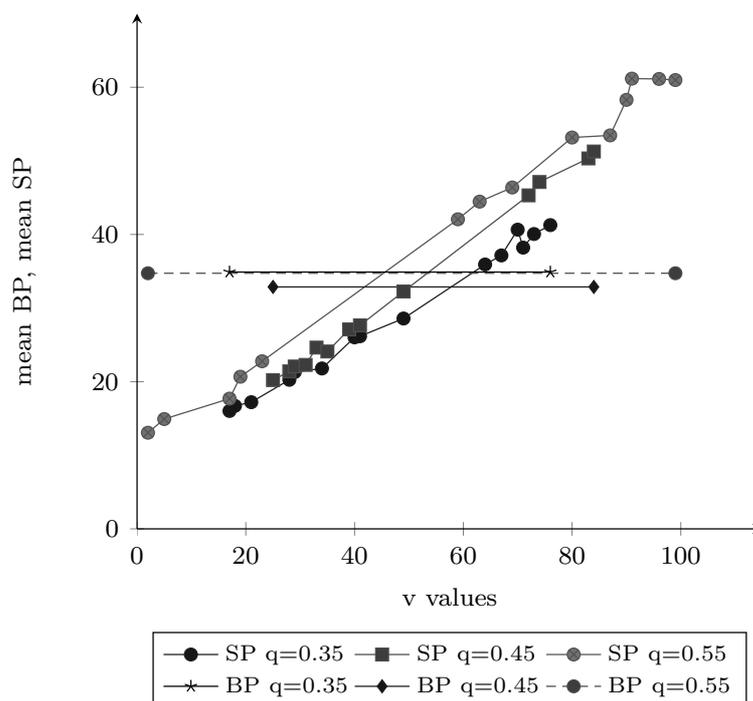
Figure 1: TD phase 1

The price acceptance levels of sellers increase in v and q. For an interpretation of this result, recall that the payoff for a seller is given by the expression $(BP - qv)$ and decreases in q and v. Given that payoffs become negative when $BP < qv$, participants apparently understood the interplay of own payoff and the parameters q and v, as they adapted their decisions to avoid negative payoffs by choosing a higher price acceptance level BP for higher values of q and v. The same is true for treatment TBD, where only buyers are informed about v; see figure 2.

Comparing phase 1 of both treatments reveals the basic difference, namely that the intersection points of the curves BP and SP are situated further to the left in treatment TD. Recall that trade only takes place in case of $BP \geq SP$, what is fulfilled left of the intersection points of the respective curves in figures 1 and 2. Thus, comparing the treatments shows that trade is conducted more often in treatment TBD than in treatment TD, where the informed seller sets higher acceptance levels in fear of negative payoffs.
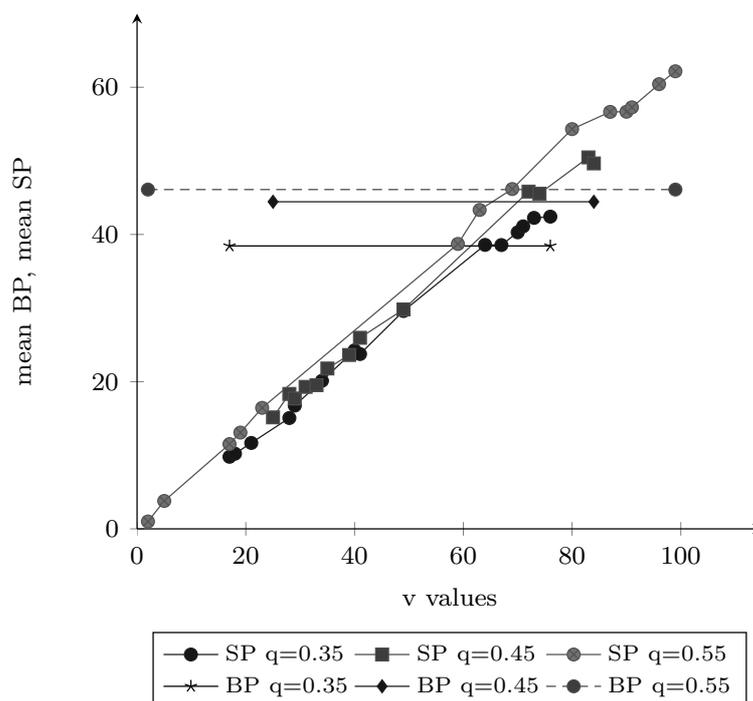
Figure 2: TBD phase 1

With respect to the transitions from phase 1 to phase 2 in both treatments, hypothesis 1 implies that in the setting where the potential buyer of a firm is not informed about the realization of v (treatment TD) welfare increases as a result of compulsory information disclosure only in case of $q > 1/2$. For $q \leq 1/2$ the elimination of asymmetric information is not predicted to have an effect on welfare. A simple comparison of the sum of payoffs in phases 1 and 2 in treatment TD reveals that, other than predicted by the theoretical benchmark model, the elimination of asymmetric information increases welfare for any value of q (see table 3).

	$q = 0.35$	$q = 0.45$	$q = 0.55$
Sum of payoffs in phase 1	12,326.6	8,541.5	5,211.4
Sum of payoffs in phase 2	14,029.6	10,608.4	7,865.5
Δ (phase 2-phase 1)	1,703.9	2,066.9	2,654.1

Table 3: Comparison of the sum of payoffs in phases 1 and 2 in treatment TD

Mann-Whitney tests show that the differences between the two phases in treatment TD are all significant: on a 5% level for $q = 0.35$, on a 1% level for $q \in \{0.45, 0.55\}$. Thus compulsory disclosure as prescribed by the EU Transparency Directive increases welfare for all values of q, and this effect is strongest for the

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highest value $q = 0.55$. This finding provides some support for hypothesis 1: while the benchmark solution predicted a welfare-enhancing effect only for high values $q > 1/2$, our experimental data reveal a positive effect for all q-values, but paralleling the benchmark solution this positive effect is strongest for $q > 1/2$. We thus obtain

Result 1. *In treatment TD compulsory disclosure increases the sum of payoffs for all values of q where the effect is strongest for the highest value $q = 0.55$.*

Hypothesis 2 refers to the welfare-enhancing effect of eliminating asymmetric information for the seller of a firm as prescribed by the EU Takeover-Bid Directive.

The differences between the sum of payoffs in phases 1 and 2 reported in table 4 are all significant (Mann-Whitney tests, p-value ≤ 0.01 for $q = 0.35$, p-value ≤ 0.03 for $q = 0.45$, and p-value ≤ 0.04 for $q = 0.55$), meaning that welfare increases through compulsory information disclosure only for the smaller values of q, whereas it decreases for $q = 0.55$.

	$q = 0.35$	$q = 0.45$	$q = 0.55$
Sum of payoffs in phase 1	9,476.3	8,522.2	10,789.6
Sum of payoffs in phase 2	14,974.8	10,903.8	7,474.5
Δ (phase 2-phase 1)	5,498.4	2,381.6	-3,315.1

Table 4: Comparison of the sum of payoffs in phases 1 and 2 in treatment TBD

Thus the positive effect on welfare decreases in q as the difference in welfare between phases 1 and 2, Δ, decreases and even becomes negative for the highest realization of q. The explanation at hand is that q has a crucial effect on how many of the possible acquisitions are actually realized. By negatively affecting trade, an increasing level of q therefore reduces welfare. For an intuition, recall that a seller's payoff is given by $BP - qv$. When a seller becomes informed about the v-value, given a high value of q, he should hence increase his price acceptance level SP to avoid negative payoffs, thus potentially precluding trade. From table 5 one can calculate that the relative frequency with which trade takes place increases when moving from phase 1 to phase 2 for all values of q: by 25.9% for $q = 0.35$ (Mann-Whitney test, p-value≤ 0.01), by 20.2% for $q = 0.45$ (Mann-Whitney test, p-value≤ 0.01), and by 10% for $q = 0.55$ (Mann-Whitney test, p-value≤ 0.02). However, although information disclosure induces trade, this effect becomes significantly weaker the higher the value of q (the decrease from 59.9% for $q = 0.35$ to 50.5% for $q = 0.55$ is significant with p-value≤ 0.05, Mann-Whitney test).

	$q = 0.35$	$q = 0.45$	$q = 0.55$
Phase 1	33.5%	30.0%	40.5%
Phase 2	59.4%	50.8%	50.5%

Table 5: Relative frequencies of trade in treatment TBD

Thus the finding that in the TBD treatment compulsory information disclosure reduces welfare for $q = 0.55$ draws from the fact that due to higher price acceptance levels SP, fewer acquisitions are made the higher q. We summarize these findings in

Result 2. *In treatment TBD compulsory disclosure increases the sum of payoffs for $q \in \{0.35, 0.45\}$ and decreases it for $q = 0.55$.*

Enforcing the EU Takeover-Bid Directive would thus also be welfare enhancing but only for small values of q.

Let us now turn to the payoffs of buyers and sellers (hypotheses 3 and 4). Our analysis suggests that in treatment TD the seller suffers from information disclosure for low values $q \leq 1/2$, whereas the formerly uninformed buyer gains for all q-values (hypothesis 3). Conducting Mann-Whitney tests, we find for all q-values that in treatment TD buyers' payoffs are significantly higher in phase 2 (p-value≤ 0.01), whereas sellers' payoffs are significantly lower in phase 2 (p-value≤ 0.02) for $q \in \{0.35, 0.55\}$ and the difference for $q = 0.45$ is insignificant. This only partly supports hypothesis 3 as the sellers' payoffs should have revealed a nonsignificant change for the highest value $q = 0.55$.

For treatment TBD the theoretical benchmark proposes that the buyers' payoffs increase, whereas sellers do not gain from becoming informed (hypothesis 4). The experimental data, however, suggest that sellers' payoffs significantly increase when buyers' private information is disclosed (Mann-Whitney test, p-value ≤ 0.02), while buyers' payoffs do not significantly change. This finding contradicts hypothesis 4 what might be explained by the fact that payoffs derived in the theoretical benchmark model are expected payoffs using an expectation of the random v, whereas in phase 2 of the experiment participants set prices knowing the realization of v. Both findings are summarized in

Result 3. *In both treatments, TD and TBD, compulsory disclosure significantly increases the payoff of the less informed party, whereas only in treatment TD the payoff of the better informed party significantly decreases.*

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Thus, regarding both EU directives, one can argue that eliminating asymmetric information can be profitable for the party becoming informed, while it might harm the party losing its information advantage.

6. Conclusion

We theoretically and experimentally investigate the welfare implications of institutional changes as suggested by the EU Takeover-Bid Directive and the EU Transparency Directive, both of which aim at reducing the negative effects associated with insider information. Our experimental treatments begin with market scenarios characterized by asymmetric information before switching to the situation where this private information becomes commonly known due to a compulsory disclosure of information.

We answer our research questions by discussing a case of bilateral trade, namely the potential takeover of a firm. This has already been analyzed by Samuelson and Bazerman (1985) who, however, consider only the case of the seller being aware of his firm's value but do not explicitly study the transition from asymmetric to symmetric information. While we do not deny that a better informed seller represents the more natural setting of private information, we consider it likely that the profitability of a firm may also depend on external events about which the potential buyer is better informed. For example, a potential buyer may have learned that a major customer, e.g., a public authority or a large commercial customer, has decided to increase its demand to be met by the firm under consideration, while the seller himself is unaware of this. Moreover, in order to analyze the economic effects of the Takeover-Bid Directive in addition to those of the Transparency Directive, it is necessary to include the other scenario of private information in which the buyer's price choice is partly information revealing.

Our theoretical and experimental results are supportive of both directives as informing both market sides fully is welfare enhancing, with the increase in case of the Takeover-Bid Directive being significant even for a low value of the firm, for which no such increase had been predicted by the theoretical benchmark solution. As regards the Transparency Directive, we find that for the highest value of the firm a trade-inhibiting effect overcompensates the positive effect on welfare, while for lower values compulsory disclosure significantly increases welfare.

In our theoretical analysis the gains from trade are one-sided (with one exception) due to granting ultimatum bargaining power to the potential buyer. On the

one hand, this can be justified as being intuitive since the potential buyer will usually decide whether he is interested in the firm and take the initiative by making an ultimatum price offer. On the other hand, the robust findings of ultimatum experiments in general suggest that potential seller participants will gain from trade even when this is not predicted.

For both directives we find that compulsory disclosure significantly increases the payoff of the less informed party, whereas only in case of the Transparency Directive the payoff of the better informed party, the seller, significantly decreases.

Overall, our theoretical and experimental results are confirmatory of the considered EU directives in that the compulsory disclosure of information is welfare enhancing for the majority of the tested parameter values.

Appendix

INSTRUCTIONS

General information

Thank you for participating in this experiment. Please remain silent and turn off your mobile phones. Please read the instructions carefully and note that they are identical for each participant. From now on, you may not talk to other participants. In case you do not follow these rules, we will have to exclude you from the experiment as well as from any payment. You will receive 5 euros for participating in this experiment. The participation fee and any additional amount of money you will earn during the experiment will be paid out to you in cash at the end of the session. All participants will be paid individually, i.e., no other participant will know how much you earned. All monetary amounts in the experiment will be paid in ECU (experimental currency units). At the end, all earned ECUs will be converted into euros using the following exchange rate:

6 ECU = 1 euro.

Procedure

The experiment consists of the following parts: control questions, six rounds divided into two stages, and a final questionnaire. Before starting the first stage, three practice rounds will be held. After completing stage 1, you will receive the instructions for the second stage. At the beginning of the experiment, each participant is randomly assigned one out of two possible roles. One half of the participants will be assigned the role of a buyer, B; the other half will be assigned the role of a seller, S. You will remain in the role you have been assigned throughout the experiment, i.e., in stage 1 and stage 2.

At the end of the experiment, for each of the six rounds, one of your decisions is selected to determine your payment, i.e., one decision per round. If you suffer a loss in the six selected decisions, you can pay for it in cash or balance it by completing additional tasks at the end of the experiment. Please note that these tasks can only be used to compensate for possible losses, but not to increase your earnings. Additionally, you will receive a payment for one task from the questionnaire part.

Hence, you will receive the participation fee and payment for the questionnaire part in any case.

Detailed description of the experiment

The experiment consists of two stages, each consisting of three rounds.

The procedure of a round in stage 1 is structured as follows:

1. The computer randomly selects 15 values of v between 0 and incl. 100 ($v = 0, 1, ..., 100$). In this case, each value v between 0 and 100 can be selected with equal probability.

2. The value v is ONLY announced to the participants *[TD: in role S]* *[TBD: in role B]*.

3. Decisions of the participants.

The participant in role B chooses a buying price BP between 0 and incl. 100 ($0 \leq BP \leq 100$).

The participant in role S chooses a minimum selling price SP between 0 and incl. 100 ($0 \leq SP \leq 100$).

In each of the three rounds of stage 1 only the participants *[TD: in role S]* *[TBD: in role B]* are confronted with 15 randomly selected values of v. These informed participants select *[TD: a selling price SP]* *[TBD: a buying price BP]* particularly for each of the 15 values of $v1, v2, ..., v15$. In other words, the participants *[TD: in role S]* *[TBD: in role B]* determine in total 15 *[TD: minimum selling prices]* *[TBD: buying prices]*, which can also be identical. The uninformed participants *[TD: in role B]* *[TBD: in role S]* make only one decision per round: they decide at which *[TD: buying price BP]* *[TBD: minimum selling price SP]* they would be willing to *[TD: buy]* *[TBD: sell]*. At the end of the experiment, one of the values of v is randomly selected for each round. Based on that value, the earnings for sellers S and buyers B are determined.

If the buying price BP offered by B is less than the minimum selling price SP by seller S, no sale takes place and no gains from the trade are generated, i.e., the earnings of S and B are 0.

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If the buying price BP offered by B is higher than or equal to the minimum selling price SP, seller S accepts the bid made by buyer B, and the following earnings result from these choices:

The buyer receives the random value v minus the offered buying price BP.

The seller receives the buying price BP proposed by B minus a share in the amount of $x\%$ of the random value v.

The amount of $x\%$ varies in the three rounds of a stage and can either correspond to 35%, 45%, or 55%, while the sequence of these three x-values is determined randomly.

Therefore, the earnings in the event of a trade can be summarized as follows:

B receives $(v - BP)$,

S receives $(BP - x\%v)$,

where $x\%$ may correspond to either 35%, 45%, or 55%.

Please note that profits from the sale are only positive for both participants – buyer B and seller S – if the randomly selected value v is higher than the buying price BP and this, in turn, is higher than $x\%$ v $(v > BP > x\%v)$.

If v is less than BP, buyer B receives a negative payoff due to the purchase. If BP is less than $x\%$ v, seller S receives a negative payoff due to the sale.

Therefore, seller S owns a good that has value v for buyer B but is less valuable for the latter, namely $x\%$ of value v. Depending on the buying price BP, on $x\%$ and on the value v, it can be advantageous for S to sell to B.

You will receive the instructions for stage 2 at the end of stage 1.

Before stage 1 of the experiment begins, we will ask you to answer a few control questions to help you better understand the rules of the experiment. This will be followed by practice rounds, to become familiar with the structure of the experiment. If you have any questions, please raise your hand.

Instructions for stage 2

In each of the three rounds of stage 2, both participants (in role S and B) are confronted with 15 values of v randomly drawn by the computer. Participants in role B decide on a buying price BP for each of the 15 values of $v1, v2, ..., v15$, and participants in role S choose a minimum selling price SP for each of the 15 values. At the end of the experiment, one of these values v is randomly selected for each round and then used to determine the earnings of sellers S and buyers B as in stage 1. The difference to stage 1 consists only in the fact that all participants – instead of just the participants *[**TD**: in role S] [**TBD**: in role B]* – make their decisions in each of the three rounds based on knowing the 15 different values of v.

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