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# Concerns about rising prices may raise prices

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Abstract

## Concerns about rising prices may raise prices

by Steffen Huck, Hans-Theo Normann, and Fidel Petros*

We use a laboratory experiment to investigate whether statements from a governmental institution expressing concerns about price increases trigger such increases by facilitating tacit collusion. Such statements on market conduct are disclosed after an exogenous and unexpected upward cost shock. The two potential channels affecting tacit collusion work through (i) a reduction of strategic uncertainty and (ii) an inducement of correlated beliefs. We find that issued statements of concern become a self-fulfilling prophecy, triggering price increases, and that a reduction in strategic uncertainty drives this adverse effect. Our results suggest that institutions should refrain from publishing such statements of concern.

*Keywords: beliefs, coordination device, strategic uncertainty, tacit collusion*

*JEL classification: C91, C72, L41*

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# 1 Introduction

This paper studies whether statements issued by a governmental institution that express concerns about the possibility of rising prices in a market can become a self-fulfilling prophecy. This question has not been studied before, neither theoretically nor empirically. Yet, there are profound reasons why such statements may matter for market conduct and do so in an adverse fashion: First, such statements may reduce the strategic uncertainty faced by firms, and second, they may induce correlated beliefs about competitors' inclination to collude.

Statements of concern about rising prices are often issued by regulators or other government bodies after unexpected global cost shocks. A prominent recent example of this phenomenon was the outbreak of Russia's war on Ukraine in 2022, which led to significantly higher crude oil prices. Many governmental agencies[1] responded to this by issuing statements expressing concern that gasoline retailers may use this change in market conditions as an opportunity to increase profitability by raising prices beyond changes in costs. At the same time, there were others[2] issuing statements of reassurance arguing that such price gouging was unlikely to arise as consumer search would discipline firms. As there is evidence that oil companies take such statements into account[3], one could argue that the institutions may disclose them to show a political willingness to act or to signal that they will put more effort into uncovering possible collusion. Nonetheless, adverse effects on firms' ability to tacitly collude may potentially outweigh such signaling effects.

This paper studies the consequences of both types of statements on market conduct. Such statements may, of course, be completely ineffectual, but there are also reasons why they might not be. On the one hand, both types of statements, statements of concern and statements of reassurance, may serve as a sunspot—as a device that correlates beliefs and, thus, facilitates collusion. On the other hand, such statements may simply focus beliefs and reduce strategic uncertainty, in which case, somewhat ironically, only statements of concern would be problematic. By narrowing firms' beliefs about competitors' pricing behavior on higher prices, they may trigger price increases.

Studying the consequences of such statements with field data is fraught with difficulties as they are not exogenous, and simultaneity problems loom large. This is why we employ a

[1] German Ministry of Economy declaration, U.S. President expressing concern of gas stations exerting price gouging ,Austrian Ministry of Justice declaration.

[2] See, for example, Ashworth and Kaufmann.

[3] Head of gas stations corporation argues against the possibility of price gouging and explains that it is just how such markets work (see the second half of the article).

laboratory experiment, which has the added advantage that we can measure beliefs which allows us to examine the precise mechanisms that drive market conduct and to use the exogenous allocation to treatment groups to overcome endogeneity issues.

In our experiment, we study Bertrand competition in triopolies over several rounds where, at some stage, a cost shock occurs. In our baseline treatment, the cost shock arises without being flanked by a statement about how costs may or may not change prices. This baseline is contrasted with two treatments where subjects do either observe a statement of concern ("prices are likely to increase") or a statement of reassurance ("prices are unlikely to increase").

The experiment delivers clear-cut results. While the treatment with statements of reassurance is indistinguishable from the baseline (ruling out a pure sunspot effect of statements issued by a governmental institution), we observe, following the cost shock, prices that are significantly above the baseline, both statistically and economically, after statements of concern. Statements of concern about rising prices do raise prices and become self-fulfilling prophecies.

In our experiment, the profitability of markets permanently increased by a staggering 40% after statements of concern. This is driven by beliefs. After a statement of concern, firms' beliefs that their competitors will raise prices above the equilibrium price are boosted by over 50%. This effect is remarkable as the literature has shown that once there are more than two firms in a market, the sustainability of tacit collusion hinges entirely on whether or not there is some form of communication between firms. In the absence of communication, tacit collusion has proved to be virtually impossible when there are more than two firms; see Potters and Suetens (2013) for a comprehensive overview. Viewed from this angle, third-party (governmental) communication appears to serve as a substitute for direct communication between firms.

One form of communication that is related to our setup and that has been studied in market experiments restricts the firms' message space to non-binding boilerplate price announcements; see, for example, Holt and Davis (1990) who study posted-offer markets where participants could fill in the blank in the following message: " ____ is an appropriate price for the market at this time", and find that the announcements initially raise prices. But this effect is only temporary. Prices fall and eventually reach the level of a treatment with no announcements. Harrington et al. (2016) study both non-binding boilerplate announcements and free-form cheap talk. They find that boilerplate announcements foster collusion but only in duopolies, while free-form communication does so also with larger numbers of firms. See also Fonseca and Normann (2012) who additionally show that instances of collusion can have long-lasting hysteresis effects, or Chowdhury and Crede (2020).

Another related strand of the literature studies how transparency about past pricing behavior affects collusion in repeated firm interaction. Past prices can, of course, also serve as an indication of future intentions. Huck et al. (2000) show that the effects of making past price choices available depend on whether firms can also observe each others' profits. If they can, past price information increases competition in Bertrand and Cournot markets. However, more recent contributions delving into these issues have qualified this finding by establishing the crucial role of period lengths and the frequency of interaction. As periods become shorter and interaction frequency increases, collusion becomes more prevalent. See, for example, Friedman et al. (2015) or, for the extreme of interaction in continuous time, Friedman and Oprea (2012).

The role of price transparency has also been documented in the field. Byrne and De Roos (2019) study gasoline markets (which very much served as a motivation for our study). They find that market leaders can exploit firms' ability to observe each others' pricing strategies to signal their intention to collude.

The remainder of this paper proceeds as follows. Section 2 introduces a simple theoretical framework that guides our investigation. Section 3 outlines the experimental design and procedures. Section 4 offers the main results, and Section 5 discusses our results and their implications.

# 2 Some simple theory

Consider a three-player homogeneous-good Bertrand game. The players' action sets consist of integer prices $p_i \in \{c+1, c+2, ..., \bar{p}\}$[4], with $c$ being the marginal cost. The marginal cost is the same for all firms. Demand is inelastic as long as the price does not exceed $\bar{p}$. We normalize demand to one unit. Let $\bar{\pi} = \bar{p} - c$ denote the monopoly profit. This stage game is repeated infinitely many times with $t = 0, ..., \infty$. Let the $\delta \in (0, 1)$ be the discount factor.

Suppose the three players attempt to establish collusion, each following a grim-trigger (GT) strategy. If player $i$ chooses $\bar{p}$ in $t = 0$, she receives $\bar{\pi}/3$ from $t = 0, ..., \infty$ along the equilibrium path. If she defects and sets $\bar{p} - 1$, she obtains $\bar{\pi} - 1$ in $t = 0$. This triggers the

[4]We set the minimum price to $c + 1$ rather than $c$ to avoid multiple equilibria in the stage game.

punishment path where all firms set the static Nash equilibrium price of one and obtain a profit of 1/3 in $t = 1, ..., \infty$. Accordingly, playing GT is a Subgame Perfect Nash Equilibrium (SPNE) if

$$\frac{\bar{\pi}}{3(1-\delta)} \geq \bar{\pi} - 1 + \frac{\delta}{3(1-\delta)} \;\Leftrightarrow\; \delta \geq \frac{2\bar{\pi}-3}{3\bar{\pi}-4} \equiv \underline{\delta}^{GT} \tag{1}$$

where the superscript GT indicates the usual grim trigger incentive compatibility constraint (ICC).

This inequality (1) is a necessary condition for collusion to be an SPNE. Other equilibria exist. For example, all firms always charging the lowest possible price is also an SPNE. The inequality (1) does not reflect the strategic uncertainty that players face in the presence of multiple equilibria.

Following Blonski et al. (2011) and Dal Bó and Fréchette (2011), we analyze the decision between two strategies: The collusive grim trigger (GT) and always defect (AD).[5] This means that players' action sets are now reduced to the repeated-game strategies GT and AD.[6] Provided (1) holds, all players playing GT and all players playing AD are equilibria of this game. But how do players' beliefs about their rivals playing one of these strategies affect play?[7]

Suppose a player believes that a competing firm plays GT with probability $q \in [0, 1]$ and plays AD with probability $1 - q$. Following Boczoń et al. (2024), we focus on the two polar cases of fully independent and perfectly correlated beliefs when comparing the expected payoffs from playing the two strategies.

We begin with independent (non-correlated) beliefs. When playing GT, there are two contingencies for the profit of player $i$ in period $t = 0$: With probability $q^2$ the other two players cooperate, so $i$ gets $\bar{\pi}/3$. If at least one other player defects, which happens with probability $1 - q^2$, $i$ obtains zero in period $t = 0$. For $t = 1, ..., \infty$, the strategies imply the following: If all players including $i$ cooperate in $t = 0$, $i$ also gets $\bar{\pi}/3$ in all future periods. If at least one player defects in $t = 0$, $i$ gets 1/3 in periods $t = 1, ..., \infty$. Now consider the expected payoff from playing AD. If both rival players cooperate in $t = 0$, which happens with $q^2$, $i$ obtains $\bar{\pi} - 1$. If one rival player defects, which happens with $2q(1 - q)$, $i$ obtains $(\bar{\pi} - 1)/2$. And if both rivals defect, which happens with $(1 - q)^2$, $i$ earns $(\bar{\pi} - 1)/3$. Either

[5] See also Green et al. (2015) or Boczoń et al. (2024).

[6] The AD strategy entails more than one action: A price to defect and another price during the punishment path. Following Buccirossi et al. (2020) we use the highest undercutting price, $\bar{p} - 1$, when solving for the incentive constraints.

[7] See Andres et al. (2023) for a related analysis of how cooperation is affected by beliefs in the presence of strategic uncertainty.

way, $i$ earns a profit of 1/3 in periods $t = 1, ..., \infty$. Comparing the expected profits of GT and AD, we find that GT has a higher expected payoff if and only if

$$q^2 \frac{\bar{\pi}}{3(1-\delta)} + (1-q^2)\frac{\delta}{3(1-\delta)} \quad \geq \quad (\bar{\pi}-1)\left(q^2 + \frac{2q(1-q)}{2} + \frac{(1-q)^2}{3}\right) + \frac{\delta}{3(1-\delta)} \quad (2)$$

We solve (2) for $\delta$ (see Appendix A) and get:

$$\frac{(\bar{\pi}-1)(q+1)-q^2}{(\bar{\pi}-1)(q^2+q+1)-q^2} \equiv \delta^{SRUNC}, \quad (3)$$

the alternative minimum discount factor under strategic risk (SR) if beliefs are uncorrelated.

Now, consider perfectly correlated beliefs. When playing GT, the same contingencies arise as in the case of uncorrelated beliefs. When playing AD, there are only two contingencies: If both other players cooperate, which happens with probability $q$, $i$ gets $\bar{\pi} - 1$. If both opponents defect, which happens with probability $1 - q$, $i$ gets $(\bar{\pi} - 1)/3$. In both cases $i$ gets 1/3 in periods $t = 1, ..., \infty$. Comparing the expected profits of GT and AD as above, GT has a higher expected payoff if and only if

$$q\frac{\bar{\pi}}{3(1-\delta)} + (1-q)\frac{\delta}{3(1-\delta)} \quad \geq \quad q(\bar{\pi}-1) + (1-q)\frac{\bar{\pi}-1}{3} + \frac{\delta}{3(1-\delta)} \quad (4)$$

We solve (4) for $\delta$ and obtain (see Appendix A):

$$\frac{(\bar{\pi}-1)(q+1)-q}{(\bar{\pi}-1)(2q+1)-q} \equiv \delta^{SRCOR}, \quad (5)$$

the alternative minimum discount factor under strategic risk if beliefs are correlated.

We note three things: First and as expected, $\delta^{SRUNC} \geq \delta^{SRCOR} \geq \delta^{GT}$ where the inequalities are strict when $q \in (0, 1)$. Second and intuitively, $\delta^{SRCOR} = \delta^{SRUNC} = 1$ if $q = 0$, and $\delta^{SRCOR} = \delta^{SRUNC} = \delta^{GT}$ if $q = 1$. Third and important for our predictions, both $\delta^{SRUNC}$ and $\delta^{SRCOR}$ are strictly decreasing in $q$. In other words, a more optimistic belief or a higher correlation of beliefs that my rivals are cooperating relaxes the incentive constraint to cooperate. This leads to our two main predictions:

1. An increase in the belief about other competitors $q$ increases the likelihood of GT over AD.

2. An increase in the correlation of the beliefs for a fixed $q$ increases the likelihood of GT over AD.

We examine these two channels by comparing two different statements. After the cost shock, subjects either get a statement of concern that prices are likely to increase (LIKELY) or a statement of reassurance saying that an increase is UNLIKELY. Alternatively, they read no statement at all (BASELINE) (for more details, see the next section). Our theoretical considerations focus on the phase after the cost shock has occurred. Our aim is to understand the possible effects of issued statements on the correlation and/or narrowing of beliefs on tacit collusion. LIKELY should have two effects relative to BASELINE: it should increase firms' beliefs about their competitors' collusive strategies, and it should increase the correlation of beliefs. UNLIKELY, on the other hand, eliminates the first channel while leaving open the possibility of an increase in the correlation between beliefs. We thus expect the beliefs that others will raise prices to be higher in LIKELY than in the two other conditions and that, in the periods following the cost shock, average prices will be highest in LIKELY, followed by UNLIKELY, while BASELINE should have the lowest average prices.

It will be useful to define the degree of profitability (DoP) of a market as:

$$\rho = \frac{p - c}{\bar{p} - c}$$

with the market price being $p = \min\{p_1, p_2, p_3\}$. Using this degree of profitability, we expect the following ordinal ranking:

$$\rho^{LIKELY} > \rho^{UNLIKELY} > \rho^{BASELINE}.$$

# 3 Experimental Design

**General setup.** We design an experimental indefinitely repeated three-firm[8] Bertrand game in which a cost shock occurs after several rounds of play. The shock is either accompanied by a statement of concern about rising prices, a statement of reassurance, or no statement at all. We elicit beliefs about competitors' pricing behavior to understand better the precise mechanism underlying the success or failure of attempts at tacit collusion.

We implement six supergames with re-matching in matching groups of six participants each and three notable features: First, after the first three supergames, the game is paused, and belief elicitation is explained to participants.[9] Second, we implement the cost shock before the sixth supergame so that we can study how changes in costs (and issued statements) affect behavior *within* markets. Third, there is no re-matching between the fifth and the final sixth supergame.

[8]We use triopolies because the literature shows (almost) no tacit collusion in markets involving more than two firms. See Huck et al. (2004) or Horstmann et al. (2018).

[9]Instructions can be found in Appendix F.

**Oligopoly game.** The setting is an indefinitely repeated Bertrand game with homogeneous goods. The marginal costs are $c = 10$ Experimental Currency Units (ECU) and the price space is given by $p \in \{11, 12, ..., 15\}$. Participants choose a price in each period and receive feedback on their own prices and profits, as well as the prices and profits of their competitors. They also have access to the price history of all previous periods, sorted by supergame and period.

**Supergame termination**. We use the block random termination design pioneered in Fréchette and Yuksel (2017) with a block length of eight periods and a continuation probability of 7/8. If the supergame does not end during the first block, it will be announced period by period, starting with the ninth period (as first designed by Vespa and Wilson (2019)).

**Belief Elicitation.** After the end of the third supergame, the game stops, and instructions about belief elicitation are given. We mention beliefs the first time only at this stage for two reasons: This procedure provides subjects with sufficient experience to understand the dynamic incentives in indefinitely repeated games, which has been shown to be important if one wants to understand mature behavior (see, for example, Embrey et al. (2018) or Dal Bó and Fréchette (2018)). Second, we avoid the pitfalls of belief elicitation without prior experience, which has been shown to affect how subjects approach strategic interaction (Aoyagi et al., 2022). The game then resumes with belief elicitation.

For each period starting with the fourth supergame, beliefs for each possible price interval are elicited separately for each firm after the prices have been set but before feedback is received. The procedure is as follows: First, we elicit the probability that a competitor sets a price of 15 before the cost shock (30 after the cost shock). Next, we ask for the probability that a competitor will price at 15 or 14 (29 or 28). This is followed by the probability of a price of 15, 14, or 13 (30, 29, or 28), and so on. Subjects use a slider to indicate their belief for each question. The elicitation is incentivized through the binarized scoring rule (Hossain and Okui, 2013).

**Unexpected cost shock.** Before the beginning of the sixth supergame, we inform participants that marginal costs have risen to $c' = 20$ and that the reservation price has increased to $\bar{p}' = 30$. There is also a new action space given by $p' \in \{21, 22, ..., 30\}$. These changes hold the Lerner index, evaluated at the reservation price, constant[10], allowing for

[10]The Lerner index both before and after the cost shock is $\frac{\bar{p}-c}{\bar{p}} = \frac{\bar{p}'-c'}{\bar{p}'} = \frac{1}{3}$

a compelling analysis of the degree of profitability before and after the cost shock. The reservation price increase can also be motivated by the fact that when the cost of production of essential goods, like energy resources, increases, consumers have no choice but to pay more when the new marginal cost now exceeds the former reservation price. In other words, our framework assumes that firms cannot charge above a certain price and further keep demand inelastic.

**Statement disclosure.** Immediately following the upward cost shock announcement, the following statement is disclosed, if applicable:

> *A governmental economic institution in a Western state regards this type of cost increase as {likely, unlikely} to offer companies the opportunity to increase their mark-ups, that is, to increase prices proportionally above the increase in costs.*

The word likely (unlikely) is displayed in the LIKELY (UNLIKELY) treatment. This statement is shown to the participants for one minute without an option to skip ahead. Participants in BASELINE had no statement to read but also had to wait one minute before the start of the sixth supergame.

**Risk preference elicitation and questionnaire.** Since beliefs and actions may be mediated by risk preferences, participants performed the "bomb" risk-elicitation task (Crosetto and Filippin, 2013). The questionnaire collected information about demographics, self-assessment of strategic uncertainty on a Likert scale; their self-assessed knowledge of human nature (0-10) (Bruttel et al., 2023); the number of people they know participating in the same session; previous experience with lab experiments (0-10+); whether they already participated in an oligopoly experiment (0/1); and whether they study economics (0/1). The distribution of individual characteristics across treatments is reported in Appendix B and shows nice balancedness.

**Payments.** Participants are paid for four items: First, they are paid based on their firm's profits in all periods in one of the first three supergames, randomly selected. Second, they are paid based on their firms' profits in all periods in one of the supergames, four through six, also randomly selected. Third, to avoid hedging motives (Blanco et al., 2010), participants are paid for the belief elicitation in one randomly selected period from a different supergame. Finally, the risk-elicitation task is also incentivized.

**Procedures.** The experiment was conducted at the WZB-TU Lab in Berlin in German language. The experiment was computerized in Ztree (Fischbacher, 2007). Recruitment was automated, using the online recruitment software ORSEE (Greiner, 2015). A total of 270 subjects participated in the experiments: 90 subjects per treatment. We ran 15 sessions with 18 subjects each, and the average duration of the experiment was 70 minutes. Subjects were paid an average of 17 Euros in private. During each session, there were three matching groups, and each of them got a different treatment to avoid unobserved session effects as much as possible.

# 4 Results

## 4.1 Overview

The data used for this section comprise the eight periods before the cost shock and the eight periods after the cost shock. This has the advantage of having balanced groups, as supergame termination varies from market to market. The eight periods before (after) the cost shock are numbered from -8 to -1 (from 1 to 8). Period 0 does not exist, so if $t = -1$, the period next period is $t = 1$.

In our experiment, beliefs of a firm $i$ about the prices of its competitors $j$ and $k$ are elicited. To comply with the theory, the belief measure is the minimum of the beliefs from firm $i$ about firm $j$ $q_i|_j$ and $k$ $q_i|_k$, that is, $q_i = \min\{q_i|_j, q_i|_k\}$. We pre-registered three measures of beliefs: First, the belief that the competitors will play a price higher than the Nash Equilibrium. Second, the belief that the competitors will play a price inducing a weakly higher degree of profitability than in the precedent period. Third, the belief that the competitors will play the highest price. We will mainly use the first measure since, in games with a Bertrand homogeneous good setting, the literature typically looks at posted prices above the Nash equilibrium. The results using the two other belief measures can be found in Appendix E.

Table 1 shows summary statistics and indicates treatment differences. We regress prices and beliefs omitting the constant, so that the coefficients (BASELINE, LIKELY, UNLIKELY) can be read as treatment means and can be used for statistical testing in post-hoc analyses. We cluster at the matching group level.

The first half of Table 1 shows the average prices for all treatments before and after the cost shock. Prices are similar before the cost shock across treatments, particularly during the period immediately before the cost shock. In the period after the cost shock, average prices are 1.76 ECU higher in LIKELY than in BASELINE, which represents a difference of 7.1%. This difference is significant at a 5% level. In the eight periods after the cost shock, the difference between LIKELY and the two other treatments is marginally statistically significant, with differences ranging also around 7%. These results suggest that the statement of concern positively affects the posted prices, while there is no effect of the statement of reassurance on posted prices.

The second part of Table 1 displays average beliefs by treatment. While there is a marginally significant difference between the LIKELY and UNLIKELY conditions in the pooled belief observations before the cost shock, the difference decreases sharply and becomes non-significant in the period before the cost shock. In the period after the cost shock, the difference between LIKELY and BASELINE is 12 percentage points, representing a relative difference of 23.1%. This difference is marginally significant. In the eight periods after the cost shock, this difference further increases to 21.2 percentage points, representing a relative difference of 61.7% and is significant at the 5% level. The difference between LIKELY and UNLIKELY also becomes (marginally) significant, with a gap of 20.1 percentage points, equating to a relative difference of 56.7%. These results tend to indicate that the statement of concern positively affects beliefs, while the statement of reassurance does not.

**Result 1:** *Average prices and beliefs do not differ between treatments in the period preceding the price shock, but they are higher in LIKELY compared to BASELINE and UNLIKELY after the shock.*

## 4.2 Effects of the beliefs on the price

The results above suggest that the statement of concern has a self-fulfilling effect on posted prices. We want to understand whether changes in beliefs drive these outcomes. Since the effect of beliefs on submitted prices is endogenous, we use the treatment variation as an instrument. Since we have two instruments for one endogenous variable, there is overidentification. We use a two-stage least squares (2SLS) regression clustered at the matching group level. The first-stage regression is the following :

$$q_{i,t} = \beta_0 + \beta_1 \cdot LIK_m + \beta_2 \cdot UNL_m + \beta_3 \cdot q_{i,-1} + \beta_4 \cdot p_{i,-1} + \beta_5 \cdot \rho_{i,-1} + \Delta_i + P_t + \epsilon_{i,t} \quad (6)$$

and the reduced-form specification is:

$$p_{i,t} = \gamma_0 + \gamma_1 \cdot \widehat{q_{i,t}} + \gamma_2 \cdot q_{i,-1} + \gamma_3 \cdot p_{i,t-1} + \gamma_4 \cdot \rho_{i,-1} + \Delta_i + P_t + \epsilon_{i,t} \quad (7)$$

Table 1: Average prices and beliefs by treatments

| treatments | $t$ = -8 ... -1 | $t$ = -1 | $t$ = 1 | $t$ = 1 ... 8 |
|---|---|---|---|---|
| | | Prices | | |
| BASELINE | 12.0486 | 11.8111 | 24.6778 | 23.3472 |
| | (0.2104) | (0.2042) | (0.5649) | (0.4775) |
| LIKELY | 12.2903 | 11.9222 | 26.4333 | 24.925 |
| | (0.2261) | (0.2785) | (0.5695) | (0.6761) |
| UNLIKELY | 11.8069 | 11.7778 | 25.2444 | 23.2403 |
| | (0.2082) | (0.2757) | (0.5912) | (0.5285) |
| | | Treatment differences | | |
| LIKELY - BASELINE | 0.2417 | 0.1111 | 1.7555** | 1.5778* |
| | (0.4382) | (0.7492) | (0.0340) | (0.0632) |
| LIKELY - UNLIKELY | 0.4834 | 0.1444 | 1.1889 | 1.6847* |
| | (0.1230) | (0.7142) | (0.1546) | (0.0560) |
| UNLIKELY - BASELINE | -0.2417 | -0.0333 | 0.5666 | -0.1069 |
| | (0.4187) | (0.9230) | (0.4920) | (0.8813) |
| | | Beliefs | | |
| BASELINE | 0.2827 | 0.2256 | 0.5201 | 0.3435 |
| | (0.0608) | (0.0625) | (0.0500) | (0.0477) |
| LIKELY | 0.4169 | 0.2839 | 0.6404 | 0.5555 |
| | (0.0682) | (0.0762) | (0.0501) | (0.0783) |
| UNLIKELY | 0.2368 | 0.2244 | 0.5662 | 0.3544 |
| | (0.0605) | (0.0712) | (0.0627) | (0.0689) |
| | | Treatment differences | | |
| LIKELY - BASELINE | 0.1342 | 0.0583 | 0.1203* | 0.212** |
| | (0.1492) | (0.5571) | (0.0962) | (0.0254) |
| LIKELY - UNLIKELY | 0.1801* | 0.0595 | 0.0742 | 0.2011* |
| | (0.0546) | (0.5716) | (0.3600) | (0.0602) |
| UNLIKELY - BASELINE | -0.0459 | -0.0012 | 0.0461 | 0.0109 |
| | (0.5952) | (0.9907) | (0.5682) | (0.8967) |

The top quarter of the table displays the coefficients of OLS regressions on posted prices and beliefs, omitting the constant and clustered at the matching group level. The coefficients can be read as treatment averages. Each column represents an OLS regression using the data of a period or a series of periods. The second (fourth) quarter of the table shows the treatment differences in posted prices (beliefs). In the top and third quarters (second and fourth quarters) of the table, standard errors (F-Test statistics) are in parenthesis. Treatment differences significantly different from zero at 1% (***), 5% (**), 10% (*).

where $q_{i,t}$ is the belief measure of the subject in the role of a firm $i$ in period $t$ after the cost shock (a negative number representing a period before the cost shock). $LIK_m$ ($UNL_m$) is a dummy variable that equals 1 when the market $m$ faces a statement of concern (statement of reassurance) and 0 otherwise. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ is the belief measure, submitted price of firm $i$ and the degree of profitability of market $m$ at the period preceding the cost shock, respectively. $\Delta_i$ represents the idiosyncratic characteristics of a firm, and $P_t$ represents the period dummies. We run a regression for the first period after the cost shock and another one for the eight periods after the cost shock. Before presenting the results of the first stage, we have to check (i) the strength of our instruments, (ii) whether we have overidentifying restrictions, and (iii) whether the treatments affect posted prices only through beliefs.

Our instruments are weak according to the rule-of-thumb of Staiger and Stock (1997) because $F = 2.08 < 10$. However, identification is not threatened because both weak instrument robust tests, Anderson-Rubin (AR) and Conditional Likelihood Ratio (CLR), reject the null hypothesis that $\gamma_1 = 0$.[11] Moreover, the Sargans-Hansen test of overidentifying restrictions[12] is not rejected in both IV regressions, including the first period and the eight periods after the cost shock ($p = 0.9902$ and $p = 0.9407$, respectively). Finally, variables that could affect posted prices—and are used as control variables—have been determined before the cost shock, such as experience in the game through more played rounds, a longer fifth supergame, or past posted or market prices. Still, some other variables may have been influenced by the treatments and, therefore, could have indirectly affected posted prices after the shock. Thus, we test whether the treatments affect risk preferences, self-assessed strategic uncertainty attitudes, and self-assessed knowledge of human nature to indicate whether the instruments could affect posted prices through channels other than beliefs. We find no evidence that this could be the case; the corresponding regressions can be found in Appendix C.

Table 2[13] shows the results of regression (6). The first column uses the belief measure in the first period after the shock as a dependent variable. The LIKELY treatment adds 10.3

[11] Andrews et al. (2019) states in their literature review that there is no consensus for procedures with weak instruments in over-identified models with non-homoskedastic errors, mainly because the tests are not considered efficient. Nevertheless, AR and CLR tests are robust. We report on Table 3 the lower bounds of AR and CLR confidence sets. As errors are not normal, the upper bound of the confidence sets is above the interval of the 100 grid points. However, one can notice that the lower bound for both tests is higher than the lower bound of the 95% confidence intervals of the estimated coefficient in the 2SLS or Limited Information Maximum Likelihood (LIML) specifications.

[12] The joint null hypothesis is that the instruments are valid, that is, they are uncorrelated with the error term, and the excluded instruments are correctly excluded from the estimated equation.

[13] The regressions with the full set of controls are reported in Table 7 in Appendix D.

percentage points to the belief that competitors' prices are higher than the marginal cost. This represents a 20% increase compared to the level in BASELINE. The effect is marginally significant after correction for multiple hypotheses.[14] This effect seems to increase further for the whole supergame, considering the third column of Table 2, where the effect of the LIKELY condition is 18.8 percentage points on beliefs, which represents an average relative increase of 54.6 % compared to the BASELINE. This is significant at the 5% level. However, the effect of the UNLIKELY condition is not different than the effect of the BASELINE condition. This suggests that the statement of concern has more than just a sunspot effect, that is, an effect where every targeted statement, irrespective of its core, would be sufficient to boost firms' coordination. The belief of the period preceding the cost shock has an auto-correlative effect on the belief of the period following the cost shock, ranging around 0.4, whereas the posted price and the market profitability of the period preceding the cost shock do not drive the current belief if a cost shock happens in between.

**Result 2:** *The LIKELY statement persistently shifts beliefs upwards. We find no effect for the UNLIKELY statement.*

Table 3[15] shows for the period(s) following the cost shock OLS price regressions (left-hand side) and the effect of the instrumented, fitted beliefs on the posted price (right-hand side). The first two columns in the left half of the table show the association between belief and prices, which is positive, as expected. The third and fourth columns display the direct effect of the instruments on the prices, which is positive for LIKELY and non-significantly different from zero for UNLIKELY. The right half of Table 3 reports IV regressions on the period(s) following the cost shock. Since the instruments are weak, we also report the LIML regressions coefficient next to the 2SLS ones since the latter can be biased towards OLS in the case of weak instruments. It is immediately recognizable that the coefficients and standard errors are very similar, supporting our results' robustness. Moreover, the lower bound of the AR and CLR 95% confidence sets mostly display a larger value than the lower bound of the 95% confidence intervals of the IV regression, representing additional evidence that the endogenous regressor has a significant effect on posted prices. Each percentage point increase in the level of fitted belief yields a 0.16 ECU increase in the price. Since the LIKELY

[14] We use Romano-Wolf $p$-values derived from block bootstrapped standard errors with 9999 resample repetitions.

[15] The regressions with the full set of controls are reported in Table 8 in Appendix D.

Table 2: First-stage belief regressions

| Dep.Var. period(s) | belief $t=1$ | MHT rw pvalue | belief $t>0$ | MHT rw pvalue |
|---|---|---|---|---|
| constant | 0.3636 | | 0.1882 | |
| | (0.2557) | | (0.2200) | |
| LIKELY | 0.1032** | | 0.1878*** | |
| | (0.0510) | [0.0582]* | (0.0649) | [0.0139]** |
| UNLIKELY | 0.0290 | | 0.0084 | |
| | (0.0562) | [0.6079] | (0.0377) | [0.8249] |
| $q_{i,-1}$ | 0.3937*** | | 0.5532*** | |
| | (0.0729) | | (0.0721) | |
| $p_{i,-1}$ | 0.0149 | | 0.0184 | |
| | (0.0201) | | (0.0206) | |
| $\rho_{m,-1}$ | 0.0348 | | 0.0921 | |
| | (0.1506) | | (0.1611) | |
| No. of observations | 270 | | 2160 | |
| No. of clusters | 45 | | 45 | |
| $R^2$ | 0.3149 | | 0.4483 | |

The table shows the results of regression (6), including all control variables, but this table shows only the most important ones here for reasons of exposition. The comprehensive Table 7 in Appendix D shows the same regressions with all controls. The first regression is the first-stage regression of the effect of the statements on the belief in the first period after the cost shock. The third column displays the results of the same regression but pools all 8 periods after the cost shock. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level, and stars on the coefficients are related to unadjusted $p$-values. The second and fourth columns show the adjusted $p$-value of the multiple hypotheses testing using the Romano-Wolf procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

condition increases beliefs by 10.3 (18.8) percentage points in the period after the cost shock (in the eight periods after the supergame), it implies that the LIKELY statement leads, on average, to prices that are 1.65 (1.58) ECU higher. This represents an increase of 6.7% (6.9%) compared to the BASELINE condition average prices. In other words, the statement of concern allows firms to increase their margin since prices grow more than proportionally

Table 3: Second-stage price regressions

| | OLS regressions | | | | IV regressions | | | |
|---|---|---|---|---|---|---|---|---|
| Dep.Var. | price | price | price | price | price | price | price | price |
| period(s) | $t = 1$ | $t > 0$ | $t = 1$ | $t > 0$ | $t = 1$ | $t = 1$ | $t > 0$ | $t > 0$ |
| IV method | | | | | 2SLS | LIML | 2SLS | LIML |
| constant | 17.6800*** | 18.5287*** | 18.8366*** | 19.2886*** | 13.0003*** | 13.0002*** | 17.7005*** | 17.7004*** |
| | (2.0983) | (1.0382) | (2.3302) | (1.2694) | (4.2023) | (4.2024) | (1.3797) | (1.3799) |
| belief | 3.0846*** | 3.4931*** | | | 16.0423*** | 16.0426*** | 8.4142*** | 8.4149*** |
| | (0.7021) | (0.4956) | | | (6.1499) | (6.1501) | (1.8303) | (1.8306) |
| LIKELY | | | 1.6542*** | 1.5702*** | | | | |
| | | | (0.5079) | (0.4624) | | | | |
| UNLIKELY | | | 0.4576 | 0.0492 | | | | |
| | | | (0.5475) | (0.2894) | | | | |
| $q_{i,-1}$ | 1.8248*** | 0.3857 | 2.7849*** | 2.1383*** | -3.5314 | -3.5316 | -2.5176* | -2.5180* |
| | (0.5156) | (0.5635) | (0.6509) | (0.6319) | (2.7231) | (2.7232) | (1.2984) | (1.2986) |
| $p_{i,-1}$ | 0.4629** | 0.2533*** | 0.4563** | 0.2799*** | 0.2168 | 0.2168 | 0.1252 | 0.1252 |
| | (0.2138) | (0.0694) | (0.2257) | (0.0970) | (0.2725) | (0.2725) | (0.1156) | (0.1156) |
| $\rho_{m,-1}$ | 0.4203 | 4.6889*** | 1.1299 | 5.4140*** | 0.5722 | 0.5722 | 4.6439*** | 4.6439*** |
| | (0.9661) | (0.8620) | (1.1951) | (0.9677) | (1.8194) | (1.8194) | (0.9349) | (0.9349) |
| No. of obs. | 270 | 2160 | 270 | 2160 | 270 | 270 | 2160 | 2160 |
| No. of clust. | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| $R^2$ | 0.4053 | 0.5837 | 0.3676 | 0.5156 | | | | |
| 95% CI lower | | | | | 3.9888 | 3.9886 | 4.8269 | 4.8269 |
| t-test $p$ | | | | | 0.0091 | 0.0091 | $< 0.0001$ | $< 0.0001$ |
| AR lower | | | | | 5.5716 | 5.5715 | 4.1385 | 4.1383 |
| AR test $p$ | | | | | 0.0112 | 0.0112 | 0.0125 | 0.0125 |
| CLR lower | | | | | 7.0326 | 7.0325 | 4.8632 | 4.8631 |
| CLR test $p$ | | | | | 0.0109 | 0.0109 | 0.0124 | 0.0124 |

The left part of this table reports OLS regressions on the price. The first two columns display specification with the endogenous belief regressor. The third and fourth columns report the direct effect of the instruments on the price. The right part of the table shows the results of the IV regression (7). 2SLS for Two-Stages Least Squares and LIML for Limited Information Maximum Likelihood. All regressions include all control variables, but this table displays only the most important ones for reasons of exposition. The comprehensive Table 8 shows this same table, including all control variables, in the Appendix D. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

to the costs.

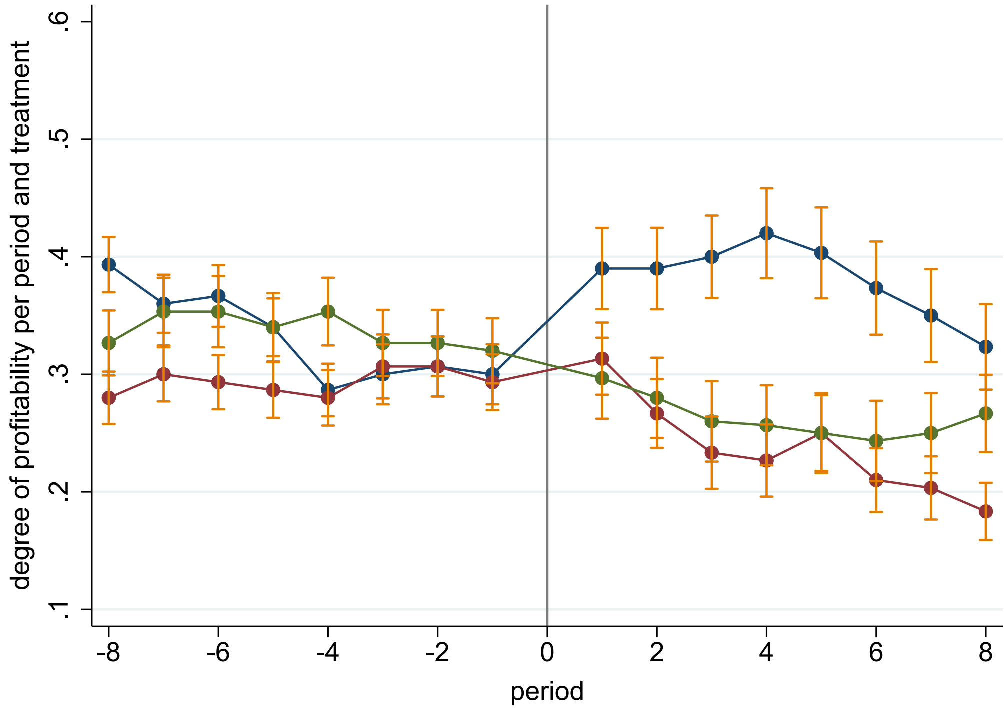
**Result 3:** *Higher beliefs lead to higher posted prices. The LIKELY statement increases beliefs. Reduction of strategic uncertainty is thus a driver of higher prices.*

## 4.3 The effects of the statements on market prices

Higher posted prices after the statement of concern do not necessarily indicate tacit collusion. For the intervention to have a negative effect on customers, we need to show that market prices also increase. Since we cannot compare market prices before and after the cost shock, we focus here on the degree of profitability (DoP), defined above as $\rho = (p-c)/(\bar{p}-c)$ where $p$ is the market (minimum) prices.

Figure 1 shows how profitability, $\rho$, evolves across periods and treatments. We can see the similarity of the treatment groups before the shock. After the shock, we see that $\rho$ is persistently higher in LIKELY than in the other two conditions.

Figure 1: Evolution of the degree of profitability ($\rho$)




Treatment LIKELY is depicted in blue, treatment UNLIKELY in red, and treatment BASELINE in green. The grey vertical line indicates the period of the shock. Standard errors (in orange) are clustered at the matching group level.

In order to statistically validate the evidence in Figure 1, we measure $\rho$ at different times. First, measuring $\rho$ in periods $t = -8, ..., -2$ versus $\rho$ in period $t = -1$ yields a difference of 0.0175 in BASELINE, 0.0317 in LIKELY, and zero in UNLIKELY. There are no statistical differences between these treatment means in pairwise comparisons.[16] Next, we measure $\rho$ in periods $t = -1$ and $t = +1$. The difference between the two is -0.023 in BASELINE, 0.09 in LIKELY, and 0.02 in UNLIKELY. There is a significant difference between LIKELY and the BASELINE, but not between the other pairwise comparisons[17]. Finally, we measure $\rho$ in periods $t = -1$ versus $t = 1, ..., 8$. The average difference between these measures is -0.0571

[16]Wald tests: LIKELY-BASELINE, $p = 0.4416$; LIKELY-UNLIKELY, $p = 0.2773$; and UNLIKELY-BASELINE, $p = 0.5614$.

[17]Wald tests: LIKELY - BASELINE, $p = 0.0118$, LIKELY - UNLIKELY $p = 0.2674$; UNLIKELY - BASELINE $p = 0.4360$.

in BASELINE, 0.0813 in LIKELY and -0.0575 in UNLIKELY. Here, LIKELY is statistically significantly different from the two other conditions.[18]

The effect of the statement on the degree of profitability in the period(s) after the cost shock is estimated by the following OLS regression, clustered at matching group level:

$$\rho_{m,t} = \eta_0 + \eta_1 \cdot LIK_m + \eta_2 \cdot UNL_m + \eta_3 \cdot \min_m\{q_{i,-1}\} + \eta_4 \cdot \rho_{m,-1} + \bar{\Delta}_m + P_t + u_{m,t} \qquad (8)$$

Since there are 90 markets but 270 beliefs and individual characteristics measured, we take the minimum of the beliefs and the average of the individual characteristics at the market level. Table 4[19] shows that the LIKELY condition significantly increases the degree of profitability by 10.3 percentage points compared to BASELINE, while the effect of UNLIKELY is negligible. For a degree of profitability of around 30% before intervention in all groups, this means an increase in market profitability of around 30%. This effect is persistent as the degree of profitability increases, on average, over the 8 periods following the statement of concern by 12.4 percentage points, providing an increase of market profitability of above 40%. The lowest belief about competitors playing above the Nash Equilibrium within a market has an auto-correlative value of more than one-half in the first period after the cost shock. The degree of profitability of the period preceding the cost shock also impacts the degree of profitability of the period after the shock with an auto-correlative value of around one-fourth. The effect of both control variables lasts on the whole supergame following the cost shock.

**Result 4:** *The LIKELY statement has a positive and persistent effect on the degree of profitability, while there is no evidence of the effect of the UNLIKELY statement.*

# 5 Concluding Remarks

Concerns expressed by economic institutions or governments can serve as a coordinating device for firms to coordinate towards higher levels of prices and profitability after a large unexpected cost shock. Using exogenous treatment variation to instrument for the effect of beliefs about competitors' collusive behavior on prices, we show that the channel through

[18]Wald tests: LIKELY-BASELINE, $p = 0.0064$; LIKELY-UNLIKELY, $p = 0.0061$; BASELINE-UNLIKELY, $p = 0.9860$.

[19]The regressions with the full set of controls are reported in Table 9 in Appendix D.

Table 4: Degree of Profitability regressions

| Dep.Var. period(s) | Deg. profit. $t = 1$ | MHT RW pvalue | Deg. profit. $t > 0$ | MHT RW pvalue |
|---|---|---|---|---|
| constant | 0.2056 | | 0.0578 | |
| | (0.2868) | | (0.1423) | |
| LIKELY | 0.1031*** | | 0.1238*** | |
| | (0.0360) | [0.0104]** | (0.0348) | [0.0054]*** |
| UNLIKELY | 0.0042 | | -0.0130 | |
| | (0.0441) | [0.9254] | (0.0029) | [0.5740] |
| $min_m\{q_{i,-1}\}$ | 0.5442*** | | 0.3885*** | |
| | (0.0988) | | (0.1090) | |
| $\rho_{m,-1}$ | 0.2513* | | 0.4923*** | |
| | (0.1364) | | (0.1539) | |
| No. of observations | 90 | | 720 | |
| No. of clusters | 45 | | 45 | |
| $R^2$ overall | 0.7481 | | 0.3623 | |

The table shows the results of Regression (8), including all control variables, but this table shows only the most important ones here for reasons of exposition. The comprehensive Table 9 in the appendix shows the same regression with all controls. The first column shows the regression of the effect of the statements on the degree of profitability of a market just after the shock. The third column depicts the effect of the statements on the degree of profitability over the eight periods following the cost shock. $min_m\{q_{i,-1}\}$, and $\rho_{m,-1}$ represent the minimum of the belief among market participants and the degree of profitability of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level, and stars on the coefficients are related to unadjusted p-values. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing (MHT) using the Romano-Wolf (RW) procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

which tacit collusion occurs is the reduction of strategic uncertainty about competitors' willingness to raise prices. These findings suggest that governmental institutions should refrain from disclosing such statements without considering their potential as coordinating devices. We find no evidence for the other hypothesized channel, pure correlation of beliefs.

The public debate on the energy sector in 2022 was often dominated by the abnormal profits that energy companies made during this period. Compared to more costly measures such as a temporary VAT reduction on energy products or supply-side subsidies, blaming (tacit) collusion may seem a cheap option for institutions and politicians. Our results suggest that governments should not emphasize abnormal profits and should be cautious in communicating such issues because of the additional economic costs.

There are, of course, some limitations to point out, in particular, our choice of a three-firm oligopoly and our implementation of a perfectly inelastic demand function. There is no doubt that with considerably more elastic demand, our effects would be attenuated. Yet, for many relevant applications, demand will be fairly inelastic, particularly in the short run. Related to demand, there is also a point in favor of our design: expressing concern about price increases can actually trigger panic buying. Such short-run shifts of the demand function would lead to higher prices even in the absence of (tacit) collusion. If so, our results would be conservative since we control for consumer behavior. With a larger number of firms, tacit collusion will also become harder, but remember that we examine a setting without any communication between firms. If there is some possibility to communicate, tacit collusion will get easier also in markets with more firms and a statement of concern might in itself ease that communication. For example, firms could simply publicly acknowledge that they have taken notice of the concern, sending a valuable signal to their competitors without infringing the law.

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# A Details of the model

To derive (3), take the ICC independent beliefs from the main text in (2):

$$q^2\left(\frac{\bar{\pi}}{3(1-\delta)}\right)+\left(1-q^2\right)\frac{\delta}{3(1-\delta)}\geq q^2(\bar{\pi}-1)+\frac{2q(1-q)(\bar{\pi}-1)}{2}+\frac{(1-q)^2(\bar{\pi}-1)}{3}+\frac{\delta}{3(1-\delta)}.$$

Subtracting $\frac{\delta}{3(1-\delta)}$ yields:

$$q^2\left(\frac{\bar{\pi}}{3(1-\delta)}\right)-q^2\left(\frac{\delta}{3(1-\delta)}\right)\geq\frac{\bar{\pi}-1}{3}(q^2+q+1).$$

Multiplying by $3(1-\delta)$, we obtain:

$$q^2\bar{\pi}-q^2\delta\geq(\bar{\pi}-1)(q^2+q+1)(1-\delta).$$

Rearranging gets us

$$q^2\bar{\pi}\delta+q\bar{\pi}\delta+\bar{\pi}\delta-2q^2\delta-q\delta-\delta\geq q\bar{\pi}+\bar{\pi}-q^2-q-1$$

and factoring for $\delta$ yields

$$\delta\left[(\bar{\pi}-1)(q^2+q+1)-q^2\right]\geq(\bar{\pi}-1)(q+1)-q^2.$$

Dividing by $[(\bar{\pi}-1)(q^2+q+1)-q^2]$ finally yields (3).

The ICC for perfectly correlated beliefs in (4) in the main text reads:

$$q\left(\frac{\bar{\pi}}{3(1-\delta)}\right)+(1-q)\frac{\delta}{3(1-\delta)}\geq q(\bar{\pi}-1)+\frac{(1-q)(\bar{\pi}-1)}{3}+\frac{\delta}{3(1-\delta)}.$$

In order to derive (5), we subtract $\frac{\delta}{3(1-\delta)}$ on both sides of the equation and get

$$q\left(\frac{\bar{\pi}}{3(1-\delta)}\right)-q\left(\frac{\delta}{3(1-\delta)}\right)\geq\frac{\bar{\pi}-1}{3}(2q+1).$$

Multiplying with $3(1-\delta)$, we obtain:

$$q\bar{\pi}-q\delta\geq(\bar{\pi}-1)(2q+1)(1-\delta).$$

Rearranging yields:

$$2q\bar{\pi}\delta+\bar{\pi}\delta-3q\delta-\delta\geq q\bar{\pi}+\bar{\pi}-2q-1.$$

Factoring for $\delta$, we get:

$$\delta\left[(\bar{\pi}-1)(2q+1)-q\right]\geq(\bar{\pi}-1)(q+1)-q$$

where multiplying by $[(\bar{\pi}-1)(2q+1)-q]$ yields (5).

# B Distribution of Individual Characteristics across Treatments

Table 5: Individual Characteristics across Treatments

| | ALL | LIK | UNL | BAS | p-value LIK-UNL | p-value LIK-BAS | p-value UNL-BAS |
|---|---|---|---|---|---|---|---|
| age | 26.6111 | 27.1778 | 25.9556 | 26.7 | 0.1676 | 0.6670 | 0.4400 |
| | (0.4033) | (0.7355) | (0.4870) | (0.8296) | | | |
| gender | 0.3667 | 0.3778 | 0.3889 | 0.3333 | 0.8790 | 0.5360 | 0.4406 |
| | (0.0294) | (0.5139) | (0.5017) | (0.0500) | | | |
| risk aversion | -8.2704 | -11.0778 | -6.5444 | -7.1889 | 0.0685 | 0.1299 | 0.8013 |
| | (1.0358) | (1.7483) | (1.7500) | (1.8640) | | | |
| periods before shock | 53.5556 | 52.2667 | 54.8667 | 53.5333 | 0.0734 | 0.4402 | 0.3601 |
| | (0.6192) | (1.1518) | (0.8705) | (1.1637) | | | |
| more periods fifth supergame | 0.3111 | 0.2667 | 0.4667 | 0.2 | 0.0052 | 0.2930 | 0.0001 |
| | (0.0282) | (0.0469) | (0.0529) | (0.0424) | | | |
| studies economics | 0.4148 | 0.4667 | 0.3222 | 0.4556 | 0.0477 | 0.8820 | 0.0672 |
| | (0.0300) | (0.0529) | (0.0495) | (0.0528) | | | |
| people known | 0.3444 | 0.2667 | 0.1667 | 0.6 | 0.5104 | 0.3475 | 0.1938 |
| | (0.1199) | (0.1376) | (0.0637) | (0.3261) | | | |
| knows experiment | 0.0667 | 0.0778 | 0.0556 | 0.0667 | 0.5527 | 0.7749 | 0.7573 |
| | (0.0152) | (0.0284) | (0.0243) | (0.0264) | | | |
| strategic uncertainty | 4.2148 | 4.5889 | 4.0667 | 3.9889 | 0.2072 | 0.1566 | 0.8488 |
| | (0.1691) | (0.3018) | (0.2812) | (0.2946) | | | |
| knowledge human nature | 6.6444 | 6.5222 | 6.7667 | 6.6444 | 0.4594 | 0.7094 | 0.6937 |
| | (0.1313) | (0.2449) | (0.2207) | (0.2174) | | | |
| lab experience 0 | 0.0296 | 0.0111 | 0.0333 | 0.0444 | 0.3146 | 0.1755 | 0.7018 |
| | (0.0103) | (0.0111) | (0.0190) | (0.0218) | | | |
| lab experience 1-3 | 0.1037 | 0.0889 | 0.1222 | 0.1 | 0.4696 | 0.8002 | 0.6375 |
| | (0.0186) | (0.0302) | (0.0347) | (0.0318) | | | |
| lab experience 4-6 | 0.1630 | 0.2 | 0.1444 | 0.1444 | 0.3264 | 0.3264 | 1 |
| | (0.0225) | (0.0424) | (0.0373) | (0.0373) | | | |
| lab experience 7-9 | 0.1963 | 0.1889 | 0.2333 | 0.1667 | 0.4678 | 0.6986 | 0.2661 |
| | (0.0242) | (0.0415) | (0.0448) | (0.0395) | | | |
| lab experience 10+ | 0.5074 | 0.5111 | 0.4667 | 0.5444 | 0.5535 | 0.6564 | 0.2993 |
| | (0.0305) | (0.0530) | (0.0529) | (0.0528) | | | |
| No. of observations | 270 | 90 | 90 | 90 | | | |

Standard errors are shown in parenthesis.

# C Regression on potential other alternative mechanisms driven by treatments

This section presents the potential alternative mechanisms that may have an influence on posted prices after having been exposed to the treatment variation. Table 6 reports the non-significant effect of the treatment from regressions on risk preferences, strategic uncertainty attitudes, and knowledge of human nature. These results suggest that the treatments had an effect on the posted price only through the beliefs about competitors' actions.

Table 6: Potential Alternative Mechanisms Regression

| Dep.Var. | risk preferences | strategic uncertainty | knowledge of human nature |
|---|---|---|---|
| constant | -7.1889*** | 3.9889*** | 6.6444*** |
| | (1.7731) | (0.3363) | (0.1641) |
| LIKELY | -3.8889 | 0.6 | -0.1222 |
| | (2.3786) | (0.4546) | (0.2653) |
| UNLIKELY | 0.6444 | 0.0778 | 0.1222 |
| | (2.7273) | (0.4316) | (0.2535) |
| No. of observations | 270 | 270 | 270 |
| No. of clusters | 45 | 45 | 45 |

Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

# D Regression Results Showing All Controls

This section reports regression with the full set of controls of Tables 2, 3, and 4.

Table 7: First-stage belief regressions

| Dep.Var.<br>period(s) | belief<br>$t = 1$ | MHT<br>rw pvalue | belief<br>$t > 0$ | MHT<br>rw pvalue |
|---|---|---|---|---|
| constant | 0.3636 | | 0.1882 | |
| | (0.2557) | | (0.2200) | |
| LIKELY | 0.1032$^{**}$ | | 0.1878$^{***}$ | |
| | (0.0510) | [0.0582]$^{*}$ | (0.0649) | [0.0139]$^{**}$ |
| UNLIKELY | 0.0290 | | 0.0084 | |
| | (0.0562) | [0.6079] | (0.0377) | [0.8249] |
| $q_{i,-1}$ | 0.3937$^{***}$ | | 0.5532$^{***}$ | |
| | (0.0729) | | (0.0721) | |
| $p_{i,-1}$ | 0.0149 | | 0.0184 | |
| | (0.0201) | | (0.0206) | |
| $\rho_{m,-1}$ | 0.0348 | | 0.0921 | |
| | (0.1506) | | (0.1611) | |
| risk preferences | 0.0028$^{*}$ | | 0.0022$^{*}$ | |
| | (0.0014) | | (0.0011) | |
| gender | 0.0689 | | -0.0055 | |
| | (0.0480) | | (0.0375) | |
| age | -0.0047$^{**}$ | | -0.0031 | |
| | (0.0022) | | (0.0027) | |
| nb periods before cost shock | 0.0012 | | 0.0006 | |
| | (0.0024) | | (0.0022) | |
| more periods in the fifth supergame | 0.0069 | | 0.0250 | |
| | (0.0479) | | (0.0459) | |
| studies economics | -0.0286 | | -0.0255 | |
| | (0.0383) | | (0.0380) | |
| people known | -0.0051 | | 0.0020 | |
| | (0.0067) | | (0.0055) | |
| knows oligopoly | -0.1612$^{**}$ | | -0.0490 | |
| | (0.0794) | | (0.0739) | |
| strategic uncertainty preferences | 0.0060 | | 0.0084 | |
| | (0.0066) | | (0.0050) | |
| knowledge human nature | -0.0049 | | -0.0013 | |
| | (0.0114) | | (0.0073) | |
| laboratory experience 1to3 | -0.1151 | | -0.0424 | |
| | (0.1559) | | (0.0942) | |
| laboratory experience 4to6 | -0.0251 | | -0.0203 | |
| | (0.1410) | | (0.0909) | |
| laboratory experience 7to9 | -0.0118 | | -0.0197 | |
| | (0.1443) | | (0.1031) | |
| laboratory experience 10+ | -0.0260 | | 0.0023 | |
| | (0.1341) | | (0.0857) | |
| period 2 | | | -0.1000$^{***}$ | |
| | | | (0.0259) | |
| period 3 | | | -0.1246$^{***}$ | |
| | | | (0.0327) | |
| period 4 | | | -0.1784$^{***}$ | |
| | | | (0.0352) | |
| period 5 | | | -0.1738$^{***}$ | |
| | | | (0.0387) | |
| period 6 | | | -0.1853$^{***}$ | |
| | | | (0.0369) | |
| period 7 | | | -0.2180$^{***}$ | |
| | | | (0.0378) | |
| period 8 | | | -0.2280$^{***}$ | |
| | | | (0.0372) | |
| No. of observations | 270 | | 270 | |
| No. of clusters | 45 | | 45 | |

The table shows the results of Regression (6) with the full set of control variables. The first (third) column displays the first-stage regression of the effect of the statements on the belief in the first period (over the eight periods) after the cost shock. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price, and the degree of profitability of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing using the Romano-Wolf procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

Table 8: Second-stage belief regressions

| | OLS regressions | | | | IV regressions | |
|---|---|---|---|---|---|---|
| Dep.Var. | price | price | price | price | price | price |
| period(s) | $t=1$ | $t>0$ | $t=1$ | $t>0$ | $t=1$ | $t>0$ |
| constant | 17.6800*** | 18.5287*** | 18.8366*** | 19.2886*** | 13.0002*** | 17.7004*** |
| | (2.0983) | (1.0382) | (2.3302) | (1.2694) | (4.2024) | (1.3799) |
| belief | 3.0846*** | 3.4931*** | | | 16.0426*** | 8.4149*** |
| | (0.7021) | (0.4956) | | | (6.1501) | (1.8306) |
| LIKELY | | | 1.6542*** | 1.5702*** | | |
| | | | (0.5079) | (0.4624) | | |
| UNLIKELY | | | 0.4576 | 0.0492 | | |
| | | | (0.5475) | (0.2894) | | |
| $q_{i,-1}$ | 1.8248*** | 0.3857 | 2.7849*** | 2.1383*** | -3.5316 | -2.5180* |
| | (0.5156) | (0.5635) | (0.6509) | (0.6319) | (2.7232) | (1.2986) |
| $p_{i,-1}$ | 0.4629** | 0.2533*** | 0.4563** | 0.2799*** | 0.2168 | 0.1252 |
| | (0.2138) | (0.0694) | (0.2257) | (0.0970) | (0.2725) | (0.1156) |
| $\rho_{m,-1}$ | 0.4203 | 4.6889*** | 1.1299 | 5.4140*** | 0.5722 | 4.6439*** |
| | (0.9661) | (0.8620) | (1.1951) | (0.9677) | (1.8194) | (0.9349) |
| risk preferences | -0.0029 | -0.0040 | 0.0088 | 0.0062 | -0.0359 | -0.0120 |
| | (0.0114) | (0.0064) | (0.0114) | (0.0058) | (0.0254) | (0.0100) |
| gender | -0.4623 | -0.0879 | -0.2499 | -0.1039 | -1.3552* | -0.0579 |
| | (0.3294) | (0.1933) | (0.3330) | (0.1983) | (0.6915) | (0.2940) |
| age | -0.0073 | 0.0057 | -0.0265 | -0.0102 | 0.0482 | 0.0162 |
| | (0.0247) | (0.0156) | (0.0250) | (0.0174) | (0.0376) | (0.0183) |
| number of periods before cost shock | 0.0012 | -0.0069 | 0.0105 | -0.0002 | -0.0094 | -0.0055 |
| | (0.0160) | (0.0126) | (0.0181) | (0.0140) | (0.0270) | (0.0139) |
| more periods in the fifth supergame | 0.4505 | 0.4838 | 0.4333 | 0.5951 | 0.3209 | 0.3806 |
| | (0.4478) | (0.4556) | (0.4400) | (0.4823) | (0.6321) | (0.4111) |
| studies economics | -0.1280 | 0.2121 | -0.2767 | 0.0449 | 0.1833 | 0.2619 |
| | (0.4307) | (0.1920) | (0.4263) | (0.1920) | (0.5846) | (0.2733) |
| people known | -0.0128 | 0.0081 | -0.0137 | 0.0221 | 0.0677 | 0.0061 |
| | (0.0605) | (0.0377) | (0.0736) | (0.0494) | (0.0873) | (0.0266) |
| knows oligopoly | -1.0656 | -0.2284 | -1.6489** | -0.4665 | 0.9379 | -0.0540 |
| | (0.7962) | (0.4947) | (0.6764) | (0.4071) | (1.8644) | (0.6872) |
| strategic uncertainty preferences | 0.0427 | -0.0237 | 0.0399 | -0.0107 | -0.0567 | -0.0814** |
| | (0.0592) | (0.0356) | (0.0626) | (0.0397) | (0.1118) | (0.0411) |
| knowledge human nature | 0.0195 | 0.0052 | 0.0175 | 0.0135 | 0.0955 | 0.0239 |
| | (0.0887) | (0.0445) | (0.0998) | (0.0475) | (0.1539) | (0.0558) |
| laboratory experience 1to3 | -0.2622 | 0.3108 | -0.7321 | 1.0000 | 1.1130 | 0.4549 |
| | (0.9353) | (0.3296) | (1.2579) | (0.3703) | (1.8160) | (0.6461) |
| laboratory experience 4to6 | -0.5122 | 0.6119 | -0.8880 | 0.3336 | -0.4850 | 0.5030 |
| | (0.9267) | (0.3723) | (1.1180) | (0.4046) | (1.6901) | (0.6258) |
| laboratory experience 7to9 | -0.3872 | 0.3558 | -0.6294 | 0.1614 | -0.4407 | 0.3246 |
| | (0.9529) | (0.3873) | (1.2036) | (0.4392) | (1.6213) | (0.6907) |
| laboratory experience 10+ | 0.1582 | 0.4896 | -0.1059 | 0.3709 | 0.3106 | 0.3506 |
| | (0.8554) | (0.2988) | (1.1144) | (0.2746) | (1.4338) | (0.5918) |
| period 2 | | -0.5731** | | -0.9148*** | | -0.0750 |
| | | (0.2215) | | (0.2189) | | (0.3242) |
| period 3 | | -0.9981*** | | -1.4260*** | | -0.3785 |
| | | (0.2567) | | (0.2497) | | (0.3980) |
| period 4 | | -0.9289*** | | -1.5445*** | | -0.0448 |
| | | (0.3256) | | (0.3095) | | (0.5221) |
| period 5 | | -1.0485*** | | -1.6482*** | | -0.1868 |
| | | (0.3276) | | (0.3125) | | (0.5362) |
| period 6 | | -1.3009*** | | -1.9408*** | | -0.3825 |
| | | (0.3367) | | (0.3323) | | (0.5612) |
| period 7 | | -1.2424*** | | -1.9963*** | | -0.1635 |
| | | (0.3549) | | (0.3660) | | (0.5941) |
| period 8 | | -1.3594*** | | -2.1482*** | | -0.2312 |
| | | (0.3705) | | (0.3859) | | (0.6369) |
| No. of obs. | 270 | 2160 | 270 | 2160 | 270 | 2160 |
| No. of clust. | 45 | 45 | 45 | 45 | 45 | 45 |
| $R^2$ | 0.4053 | 0.5837 | 0.3676 | 0.5156 | | |
| 95% CI lower | | | | | 3.9886 | 4.8269 |
| t-test $p$ | | | | | 0.0091 | $< 0.0001$ |
| AR lower | | | | | 5.5715 | 4.1383 |
| AR test $p$ | | | | | 0.0112 | 0.0125 |
| CLR lower | | | | | 7.0326 | 4.8631 |
| CLR test $p$ | | | | | 0.0109 | 0.0124 |

The left part of this table reports OLS regressions on the price from the endogenous regressor and the direct effect from treatments. The right part of the table shows the results of the IV regression (7). IV regressions coefficients report Limited Information Maximum Likelihood estimation. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

Table 9: Degree of profitability regressions

| Dep.Var. | DoP | MHT | DoP | MHT |
|---|---|---|---|---|
| period(s) | $t = 1$ | rw pvalue | $t > 0$ | rw pvalue |
| constant | 0.2056 | | 0.0578 | |
| | (0.2868) | | (0.1423) | |
| LIKELY | 0.1031*** | | 0.1238*** | |
| | (0.0360) | [0.0104]** | (0.0348) | [0.0054]*** |
| UNLIKELY | 0.0042 | | -0.0130 | |
| | (0.0441) | [0.9254] | (0.0229) | [0.5740] |
| $min_m\{q_{i,-1}\}$ | 0.5442*** | | 0.3885*** | |
| | (0.0988) | | (0.1090) | |
| $\rho_{m,-1}$ | 0.2513* | | 0.4923*** | |
| | (0.1364) | | (0.1539) | |
| risk preferences | 0.0006 | | 0.0002 | |
| | (0.0015) | | (0.0011) | |
| gender | 0.0666 | | 0.0491 | |
| | (0.0724) | | (0.0586) | |
| age | 0.0024 | | 0.0006 | |
| | (0.0045) | | (0.0039) | |
| nb periods before cost shock | 0.0008 | | 0.0002 | |
| | (0.0013) | | (0.0012) | |
| more periods in the fifth supergame | 0.0059 | | 0.0336 | |
| | (0.0438) | | (0.0404) | |
| studies economics | -0.0941 | | -0.0048 | |
| | (0.0805) | | (0.0558) | |
| people known | 0.0136 | | 0.0219 | |
| | (0.0166) | | (0.0139) | |
| knows oligopoly | -0.3990*** | | -0.1531* | |
| | (0.1093) | | (0.0883) | |
| strategic uncertainty preferences | 0.0158 | | 0.0175** | |
| | (0.0094) | | (0.0076) | |
| knowledge human nature | 0.0002 | | 0.0014 | |
| | (0.0139) | | (0.0118) | |
| laboratory experience 1to3 | -0.1353 | | -0.1244 | |
| | (0.2291) | | (0.1037) | |
| laboratory experience 4to6 | -0.2135 | | -0.0671 | |
| | (0.2143) | | (0.0948) | |
| laboratory experience 7to9 | -0.1851 | | -0.0720 | |
| | (0.1954) | | (0.0685) | |
| laboratory experience 10+ | -0.1912 | | -0.0729 | |
| | (0.1865) | | (0.0635) | |
| period 2 | | | -0.0107 | |
| | | | (0.0181) | |
| period 3 | | | -0.0251 | |
| | | | (0.0210) | |
| period 4 | | | -0.0218 | |
| | | | (0.0280) | |
| period 5 | | | -0.0218 | |
| | | | (0.0303) | |
| period 6 | | | -0.0473 | |
| | | | (0.0329) | |
| period 7 | | | -0.0551* | |
| | | | (0.0325) | |
| period 8 | | | -0.0651* | |
| | | | (0.0329) | |
| No. of observations | 720 | | 720 | |
| No. of clusters | 45 | | 45 | |

The table shows the results of Regression (8), including all control variables. The first (third) column reports the regression of the effect of the statements on the degree of profitability of a market just after the shock (over the eight periods after the shock). $min_m\{q_{i,-1}\}$, and $\rho_{m,-1}$ represent the minimum of the belief among market participants and the degree of profitability of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing (MHT) using the Romano-Wolf (RW) procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

# E Results using the two alternative belief measures

This section reproduces the results of Table 2, 3, and 4 for the two alternative belief measures.

## E.1 Belief that competitors play a weakly higher price than previous period

Our instruments are weak also for this belief measure because $F = 2.15 < 10$. However, identification is not threatened because both weak instrument robust tests, Anderson-Rubin (AR) and Conditional Likelihood Ratio (CLR), reject the null hypothesis that $\gamma_1 = 0$. Moreover, the Sargans-Hansen test of overidentifying restrictions[20] is not rejected in both IV regressions, including the first period and the eight periods after the cost shock ($p = 0.8538$ and $p = 0.4377$, respectively).

Table 10 shows the results of regression (6) with the belief measure that competitors lay a weakly higher price than the previous period. The first column uses the belief measure in the first period after the shock as a dependent variable. The results are qualitatively the same as the main belief measure, and the coefficients are similar.

Table 11 shows the effect of the instrumented, fitted beliefs on the posted price. The left half of the table displays the OLS regressions on the period(s) following the cost shock. The first two columns show the association between belief and prices, which is, as expected, positive. The third and fourth columns display the direct effect of the instruments on the prices, which is positive for LIKELY and non-significantly different from zero for UNLIKELY. The right half of Table 11 reports IV regressions on the period(s) following the cost shock. Since the instruments are weak, we also report the LIML regressions coefficient next to the 2SLS ones since the latter can be biased towards OLS in the case of weak instruments. It is immediately recognizable that the coefficients and standard errors are roughly similar, supporting our results' robustness. Moreover, the lower bound of the AR and CLR 95% confidence sets mostly display a higher value than the lower bound of the 95% confidence intervals of the IV regression, representing additional evidence that the endogenous regressor has a significant effect on posted prices. These results are also qualitatively similar to the results with the main belief measure but with lower coefficients in the first period after the cost shock and higher coefficients in the eight periods following the cost shock.

[20] The joint null hypothesis is that the instruments are valid instruments, that is, uncorrelated with the error term, and the excluded instruments are correctly excluded from the estimated equation.

Table 10: First-stage belief regressions

| Dep.Var.<br>period(s) | belief<br>$t = 1$ | MHT<br>rw pvalue | belief<br>$t > 0$ | MHT<br>rw pvalue |
|---|---|---|---|---|
| constant | 0.8957 | | -0.0002 | |
| | (0.2930) | | (0.1871) | |
| LIKELY | 0.1085* | | 0.1181** | |
| | (0.0562) | [0.0596]* | (0.0542) | [0.0446]** |
| UNLIKELY | 0.0185 | | -0.0276 | |
| | (0.0711) | [0.7953] | (0.0420) | [0.5144] |
| $q_{i,-1}$ | 0.1888*** | | 0.1874** | |
| | (0.1719) | | (0.0894) | |
| $p_{i,-1}$ | -0.0255 | | 0.0117 | |
| | (0.0242) | | (0.0163) | |
| $\rho_{m,-1}$ | 0.1426 | | 0.4999*** | |
| | (0.2421) | | (0.1467) | |
| No. of observations | 270 | | 2160 | |
| No. of clusters | 45 | | 45 | |
| $R^2$ | 0.1064 | | 0.3149 | |

The table shows the results of Regression (6), including all control variables, but this table shows only the most important ones here for reasons of exposition. The first regression is the first-stage regression of the effect of the statements on the belief in the first period after the cost shock. The third column displays the results of the same regression but pools all 8 periods after the cost shock. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing using the Romano-Wolf procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

Table 12 shows that the LIKELY condition increases the degree of profitability by 7.2 percentage points compared to BASELINE. This effect is not statistically significant. However, the effect strengthens over time and becomes persistent as the degree of profitability increases, on average, over the 8 periods following the statement, by 10.5 percentage points, significant at the 5% level.

Table 11: Second-stage belief regressions

| | OLS regressions | | | | IV regressions | | | |
|---|---|---|---|---|---|---|---|---|
| Dep.Var. | price | price | price | price | price | price | price | price |
| period(s) | $t = 1$ | $t > 0$ | $t = 1$ | $t > 0$ | $t = 1$ | $t = 1$ | $t > 0$ | $t > 0$ |
| IV method | | | | | 2SLS | LIML | 2SLS | LIML |
| constant | 16.0709*** | 18.0222*** | 17.1969*** | 17.9149*** | 4.1813 | 4.0259 | 18.0334*** | 18.0340*** |
| | (2.4688) | (1.5247) | (2.4925) | (1.4665) | (7.2370) | (7.3704) | (1.7331) | (1.7902) |
| belief | 1.5039*** | 2.6760*** | | | 14.6151** | 14.7865** | 11.4453*** | 11.8723*** |
| | (0.5325) | (0.4954) | | | (7.1485) | (7.3034) | (2.9378) | (3.1846) |
| LIKELY | | | 1.6573*** | 1.5998*** | | | | |
| | | | (0.5795) | (0.4838) | | | | |
| UNLIKELY | | | 0.4700 | 0.0503 | | | | |
| | | | (0.6227) | (0.3347) | | | | |
| $q_{i,-1}$ | 1.4441** | 0.6958 | 1.0948 | 0.6397 | -1.6441 | -1.6844 | -1.4151 | -1.5179 |
| | (0.6671) | (0.6553) | (0.6540) | (0.5718) | (2.7847) | (2.8259) | (1.1405) | (1.2030) |
| $p_{i,-1}$ | 0.6282** | 0.3616*** | 0.5414** | 0.3498*** | 0.9157*** | 0.9194*** | 0.2233 | 0.2166 |
| | (0.2430) | (0.1039) | (0.2382) | (0.1101) | (0.3397) | (0.3432) | (0.1477) | (0.1541) |
| $\rho_{m,-1}$ | 2.1225* | 5.0916*** | 3.1958** | 7.1611*** | 1.0665 | 1.0527 | 1.2887 | 1.1035 |
| | (1.2521) | (1.0343) | (1.3163) | (0.9307) | (3.4202) | (3.4549) | (2.0444) | (2.1460) |
| No. of obs. | 270 | 2160 | 270 | 2160 | 270 | 270 | 2160 | 2160 |
| No. of clust. | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| $R^2$ | 0.3305 | 0.5262 | 0.3398 | 0.4980 | | | | |
| 95% CI lower | | | | | 0.6042 | 0.4721 | 5.6872 | 5.6305 |
| t-test $p$ | | | | | 0.0409 | 0.0429 | 0.0001 | 0.0002 |
| AR lower | | | | | 3.0102 | 2.9301 | 5.5127 | 5.4414 |
| AR test $p$ | | | | | 0.0229 | 0.0229 | 0.0127 | 0.0127 |
| CLR lower | | | | | 4.1424 | 4.6652 | 6.2107 | 6.1980 |
| CLR test $p$ | | | | | 0.0204 | 0.0204 | 0.0137 | 0.0137 |

The left part of this table reports OLS regressions on the price. The first two columns display specification with the endogenous belief regressor. The third and fourth columns report the direct effect of the instruments on the price. The right part of the table shows the results of the IV regression (7). 2SLS for Two-Stages Least Squares and LIML for Limited Information Maximum Likelihood. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

Table 12: Degree of profitability regressions

| Dep.Var. | rho | MHT | rho | MHT |
|---|---|---|---|---|
| period(s) | $t = 1$ | rw pvalue | $t > 0$ | rw pvalue |
| constant | 0.0760 | | -0.0507 | |
| | (0.3147) | | (0.1543) | |
| LIKELY | 0.0716 | | 0.1046** | |
| | (0.0486) | [0.1936] | (0.0393) | [0.0229]** |
| UNLIKELY | -0.0141 | | -0.0235 | |
| | (0.0705) | [0.8422] | (0.0347) | [0.5017] |
| $min_m\{q_{i,-1}\}$ | 0.3030*** | | 0.1896* | |
| | (0.1058) | | (0.1000) | |
| $\rho_{m,-1}$ | 0.6730*** | | 0.8176*** | |
| | (0.1233) | | (0.1312) | |
| No. of observations | 270 | | 2160 | |
| No. of clusters | 45 | | 45 | |
| $R^2$ | 0.7205 | | 0.7115 | |

The table shows the results of Regression (8) with the full set of control variables. The first (third) colmun displays the first-stage regression of the effect of the statements on the belief in the first period (over the eight periods) after the cost shock. $min_m\{q_{i,-1}\}$, and $\rho_{m,-1}$ represent the minimum of the belief among market participants and the degree of profitability of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing using the Romano-Wolf procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

## E.2 Belief that competitors play the highest price

Our instruments are weak also for this belief measure because $F = 1.14 < 10$. Moreover, identification is not valid because both the weak instrument robust tests, Anderson-Rubin (AR) and Conditional Likelihood Ratio (CLR), cannot reject the null hypothesis that $\gamma_1 = 0$, as the confidence sets are discontinued, as a union of negative and positive values. The results of the second-stage regression are thus not reliable, and further evidence of this lies in the clear difference between the 2SLS and LIML coefficients and standard errors of the IV regressions. Hence, we do not give any other interpretation insights in this part since the two-stage analysis is invalid, except that Table 13 reports non-significant coefficients of both treatments on the belief that competitors play the highest price. Thus, we do not display the tables of regression on prices and degree of profitability as there are not relevant.

Table 13: First-stage belief regressions

| Dep.Var.<br>period(s) | belief<br>$t = 1$ | MHT<br>rw pvalue | belief<br>$t > 0$ | MHT<br>rw pvalue |
|---|---|---|---|---|
| constant | -0.3896* | | -0.3492** | |
| | (0.2206) | | (0.1707) | |
| LIKELY | 0.0549 | | 0.0594 | |
| | (0.0435) | [0.2454] | (0.0540) | [0.4547] |
| UNLIKELY | 0.0835 | | -0.0089 | |
| | (0.0578) | [0.2454] | (0.0380) | [0.8153] |
| $q_{i,-1}$ | 0.4628*** | | 0.3627** | |
| | (0.1130) | | (0.1779) | |
| $p_{i,-1}$ | 0.0445** | | 0.0158 | |
| | (0.0211) | | (0.0119) | |
| $\rho_{m,-1}$ | 0.2363 | | 0.5541** | |
| | (0.1735) | | (0.2277) | |
| No. of observations | 270 | | 2160 | |
| No. of clusters | 45 | | 45 | |
| $R^2$ | 0.5069 | | 0.5655 | |

The table shows the results of Regression (6), including all control variables, but this table shows only the most important ones here for reasons of exposition. The first (third) regression is the first-stage regression of the effect of the statements on the belief in the first period after the cost shock (over the eight periods after the cost shock). The third column displays the results of the same regression but pools all 8 periods after the cost shock. $q_{i,-1}$, $p_{i,-1}$ and $\rho_{m,-1}$ represent the belief, price (at the individual level), and the degree of profitability (at the market level) of the period before the cost shock, respectively. Standard errors in parenthesis are clustered at the matching group level. The second and fourth columns show the adjusted p-value of the multiple hypotheses testing using the Romano-Wolf procedure, derived from block bootstrapped standard errors with 9999 repetitions. Coefficient significantly different from zero at 1% (***), 5% (**), 10% (*).

# F Instructions

***First part***

Welcome to this experiment. Please read the following instructions carefully. You can use them at any time during the experiment. Please do not communicate with other people during the experiment. Please do not react verbally to events during the experiment. The use of cell phones is not permitted. If you have any questions or need help, please raise your hand. Please follow these rules. Otherwise, you will be asked to leave the experiment without payment. **You will receive 6 euros for showing up on time.** Your further earnings depend on your decisions and those of the other participants. You will be paid privately in cash at the end of the experiment.

In this experiment, you take on the **role of a company** that competes with two other companies in a market. Each company produces six units of a good, costing a company 10 points when the good is sold. Companies can set the following prices: 11,12,13,14 and 15. Six consumers on the market want to buy one unit of the good at the lowest price. The consumers pay a maximum of 15 points for one unit of the good. Three companies in each market are named A, B, and C. The letter of your company is shown on the screen as your role and can change in each cycle.

The market works as follows. At the beginning of each period, all companies set their selling prices. The company that sets the lowest price sells at this price and bears the associated costs. The other companies have no customers. If several companies set the lowest price, they share the available customers. Three examples follow.

**Example 1**: Suppose the three firms choose the following prices: Company A sets a price of 14, Company B chooses a price of 13, and Company C chooses a price of 15. Company B sets the lowest price and sells all its units at a price of 13, making a profit of 6*(13-10) = 18 points. Companies A and C do not supply customers and, therefore, score 0 points.

**Example 2**: Suppose the three companies choose the following prices: Company A and Company B set a price of 12, and Company C sets a price of 13. Since firms A and B set the same price and 12 is the lowest price, they must share the available customers equally. Consequently, both companies will each sell three units at a price of 12, and thus, each makes a profit of 3*(12-10) = 6 points. Company C, on the other hand, receives 0 points.

**Example 3**: Company A, company B, and company C set a price of 14. Since firms A, B, and C set the same price and 14 is the lowest price, they must share the available customers equally. Consequently, all firms will each sell two units at a price of 14, each making a profit of 2*(14-10) = 8 points, as they divide the total market by 3.

You will be assigned to two participants for the duration of one **cycle.** You will be randomly assigned to two other participants in each of the following cycles. During a cycle, the two other companies will be visible on the screen with the name Company 1 or Company 2. On the left of the screen, you can see a table with your past prices and the two assigned companies. **You cannot know who you have interacted with in previous or future cycles.** In each cycle, we will ask you to make pricing decisions in a series of rounds.

The **number of rounds in a cycle** is determined randomly as follows: After each round, there is a probability of 7/8 that the cycle will continue for at least one more round. Specifically, after each round, a computer-generated random number between 1 and 8 determines whether the cycle will be continued for another round. If the number is lower than 8, the game continues for at least one more round. Otherwise, the game ends. For example, if you are in round 2, the probability that there will be a third round is 7/8, and if you are in round 7, the probability that there will be an eighth round is also 7/8. At any point in the game, the probability that the game will continue is 7/8.

In each cycle, a **block of 8 rounds** is carried out first. At the end of this block, you will find out whether the game has ended within the block of 8 rounds or not. If the roll of the 8-sided dice shows 8 in one of the first 8 rounds, the cycle is finished, and the last payout round is the first in which the roll of the 8-sided dice shows 8. At the end of the eighth round, the interface displays the results of the 8-sided dice roll for each of the first eight rounds on the screen. If the roll of the 8-sided die shows 8 in any of the first eight rounds, the cycle ends, **and the last payout round is the first round in which the roll of the 8-sided die shows 8**. The user interface adds up your payouts and includes the round where the cycle payout ends.

**Example:** The 8-sided die results in 4, 6, 3, 8, 4, 2, 6, 8 in the first block rounds. As 8 is higher than 7, the cycle ends in the fourth round. The computer adds up the payouts of the first four rounds accordingly.

A ninth round is carried out if all the dice results in the first eight rounds are lower than 8. From the ninth round onwards, your screen displays the result of the dice roll round by round. The cycle ends with the first round in which the dice roll shows 8. The computer adds up the payouts for all rounds up to the last round of the cycle.

There are three cycles in this first part of the experiment**,** and you will receive **a payout** for **one of these cycles**. The cycle relevant to the payout is selected at random.

The conversion rate is 1 point = 0.05 EUR

***Second part***

The basic structure of this second part is very similar to that of the first one. The course of the game and the allocation of participants remain the same until further notice.

However, you have another task in this part. In each round, after you have made a decision, you will be asked to **enter your guess about the decision of the other participants with whom you are interacting**. You give your guess for each of the two companies separately. Using a slider, you enter a number between 0 and 1, which indicates the probability (from 0.00 to 1.00) that a company will choose option A for each of the following 4 situations:

Option A: the company sets 15. Option B: the company sets 14, 13, 12 or 11.

Option A: the company sets 15 or 14, Option B: the company sets 13, 12, or 11.

Option A: the company sets 15, 14, or 13. Option B: the company sets 12 or 11.

Option A: the company sets 15, 14, 13 or 12. Option B: the company sets 11.

Your guess of option A for a situation automatically determines the guess of option B. Two different cycles from this part are randomly selected and count towards the payout. **For one of these cycles, you will receive your payout according to the explanations in part 1; for the other, the computer randomly selects a round from these cycles for the payout according to your guess.** The **guess you** make in this round determines your chance of winning a prize of 40 points twice, as you will make separate guesses for each company. To determine your payout, the computer draws a random number. This number is compared with one of the four relevant options using your slider entry to determine the chance of an option. The four relevant options are those that contain the price that the relevant company has actually set. The corresponding option for your payout is determined randomly.

**Example**: Company X plays 13. The relevant options are:
Option 15, 14 or 13; 15, 14, 13 or 12; 14, 13, 12 or 11; and 13, 12 or 11.

The rules determining your chance of winning 40 points have been deliberately designed to give you the highest chance of winning if you answer the above questions with your true assessment.

The conversion rate is 1 point = 0.05 EUR

There is now a shock throughout the economy, which increases the cost per unit sold to 20. Given the increased cost, the consumer is willing to pay up to 30 points for a unit of the good. The new price options for all three companies are as follows: 21, 22, 23, 24, 25, 26, 27, 28, 29, 30. **In addition, you remain assigned to the other two companies from the last round. This means you will interact with the same companies as in the fifth cycle.** Finally you continue to enter your guess of the following 9 situations for each company separately:

Option A: the company sets 30. Option B: the company sets 29, 28, 27, 26, 25, 24, 23, 22 or 21.

Option A: the company sets 30 or 29. Option B: the company sets 28, 27, 26, 25, 24, 23, 22 or 21.

Option A: the company sets 30, 29 or 28. Option B: the company sets 27, 26, 25, 24, 23, 22 or 21.

Option A: the company sets 30, 29, 28 or 27. Option B: the company sets 26, 25, 24, 23, 22 or 21.

Option A: the company sets 30, 29, 28, 27 or 26. Option B: the company sets 25, 24, 23, 22 or 21.

Option A: the company sets 30, 29, 28, 27, 26 or 25. Option B: the company sets 24, 23, 22 or 21.

Option A: the company sets 30, 29, 28, 27, 26, 25 or 24. Option B: the company sets 23, 22 or 21.

Option A: the company sets 30, 29, 28, 27, 26, 25, 24 or 23. Option B: the company sets 22 or 21.

Option A: the company sets 30, 29, 28, 27, 26, 25 24, 23 or 22. Option B: the company sets 21.

Otherwise, the basic structure of Parts 1 and 2 remains unchanged except for the changes mentioned above.

The conversion rate is 1 point = 0.05 EUR

***Third part of the experiment (Bomb Task)***

On your computer screen, you will see a square in which you can find 100 boxes.

You receive 2 points for every box you collect. The boxes are collected automatically: every second, a collected box changes color. The collected boxes change color, starting at the top left of the screen, and are updated accordingly.

Hidden behind one of these 100 boxes is a "bomb" that can destroy all the boxes collected. The "bomb" can be found in any box with the same probability (the probability that a "bomb" is in a particular box is 1/100). However, you do not know which box the "bomb" is located in. Your task in this part is to decide when to stop collecting the boxes. You can do this by clicking on the "STOP" button whenever you want.

If you collect the box with the "bomb," the "bomb" will "explode," and you will not receive any points. If you stop collecting the boxes before you have collected the box with the "bomb," the "bomb" will not explode, and you will receive the points you have collected up to that point. Note that you will only find out at the end of the task whether one of the boxes you have collected contains the "bomb." If you collect the box with the "bomb," the "bomb" will only explode at the end of the task: this means that you can collect the box with the "bomb" without knowing it.

The conversion rate is 1 point = 0.05 EUR

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