Diversification vs. Monopolization: A Laboratory Experiment*

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December 31, 2022

This paper is work in progress and exclusively prepared for AFA 2022. Please do not circulate the paper at this point.

Abstract

We study in a highly abstract laboratory setting whether and how subjects in the role of shareholders use the stock market to monopolize product markets. We find that shareholders holding stakes in product market rivals choose compensation packages for subjects in the role of managers that reward the latter to reduce production. Many managers act in accordance with their incentives, thus raising prices and firm profits. Although the experimental environment features no risk, most shareholders actively choose to diversify their portfolio across competitors, which gives them subsequent incentives to incentivize rival firms' managers to act as part of a monopoly.

Keywords: diversification, common ownership, agency, executive compensation, experimental corporate governance

JEL Codes: D22, D43, G11, G32, G41

*We thank the audience at the Society for Experimental Finance Conference in Bonn, and seminar audiences at Cologne, Münster Oxford, NBIM UK Consumer and Markets Authority, University of Zurich, and in particular Mark Armstrong (UCL), Giacomo Calzolari (EUI), Ernst Fehr (Zurich) Sebastien Pouget (Toulouse), Paul Smeets (Amsterdam), and John Vickers (Oxford) for helpful feedback. Frédéric-Guillaume Schneider contributed early ideas to the project. Schmalz and Ockenfels acknowledge support from Deutsche Forschungsgemeinschaft (DFG) under Germany's Excellence Strategy – EXC 2126/1–390838866. Ockenfels also acknowledges support from the European Research Council, grant agreement number EU Horizon 2020 741409). The funders had no role in the decision to publish or preparation of the manuscript.

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"Twelve major shareholders in U.S. shale-oil-and-gas producers met this September in a Midtown Manhattan high-rise to discuss a common goal, getting those frackers to make money for a change. ... They came away determined to force operators to turn profits in part by changing compensation practices that critics say reward CEOs for increasing production.
...
... it might also have the side benefit of achieving what OPEC, the global oil cartel, couldn't accomplish — getting shale companies to help shrink oil supplies and boost prices."

Wall Street Journal, 13 December 2017

"You know, Warren, it does occur to me, though, if you're building up such a significant stake in all the major players, is that anything that's, like, monopolistic behavior? Is there any concern to think that you would say something to the airlines to make them make sure that they're not competing on prices quite the same?"

Becky Quick to Warren Buffett, CNBC, 27 February 2017

1 Introduction

A competitive stock market is often thought of as an integral part of a capitalist economy: individual investors can use the stock market to diversify idiosyncratic risk. However, the stock market can also be used to remove the foundation of capitalist economies – firms' incentives to compete. In fact, investors do frequently use the stock market to actively concentrate their portfolios by buying buying large blocks of shares in product market rivals. For example, Warren Buffett's conglomerate Berkshire Hathaway was the largest shareholder in several U.S. airlines, Bill Gates' family office holds even larger stakes in competing waste management companies, and Bill Ackman's activist hedge fund Pershing Square is a large shareholder in Domino's Pizza, Chipotle, and Burger King (Amel-Zadeh et al., 2022; Schmalz, 2018).[1] This empirically observed behavior is in contrast with the prescription of

[1]Whereas the practice is best documented in U.S. public equity markets, it also extends to private equity markets and across the globe. For example, Softbank was the largest shareholder in the four ride-sharing companies Uber, Didi, Grab, and Ola. https://www.reuters.com/article/us-softbank-autos-investments-insight-idUSKCN1RO049

basic asset pricing models such as the CAPM, in which investors "passively" diversify not only across firms within the same industry but across industries. The economic dilemma for investors might be the need to trade off greater diversification benefits from holding broader portfolios against higher industry profitability from more concentrated portfolios: (some) investors may understand that holding shares in rivals gives them incentives to incentivize firm managers to reduce output or otherwise compete less aggressively, thus raising overall profits for shareholders (Rubinstein and Yaari, 1983). Whether a reduction in competition is a driving force motivating diversification within industries is, however, an open question.

The logic advanced by standard game theory is that actively choosing portfolios that feature stakes in rivals gives rise to shareholder incentives to reduce managers' incentives to compete. It has never been tested whether this logic is easily understood – or alternatively, whether strategic uncertainty, a failure to understand equilibrium responses, or other cognitive limitations prevent diversification for the purpose of a reduction of competition in practice. Our experiment begins to fill this gap. We also study which mechanisms facilitate a reduction of competition through active common ownership. In particular, we study whether communication between shareholders are conducive for shareholders to coordinate on the "cooperative" outcome that reduces competition. We thus approach an answer to the question whether an intention to reduce competition could indeed be a behaviorally robust driver of "active common ownership" in practice.

There are several reasons for using lab experiments to begin studying the question under which circumstances investors diversify their holdings across competitors for strategic reasons rather than risk reduction. First, and most importantly, doing so allows us to rule out the reduction of idiosyncratic risk as a driver of portfolio decisions; this potential confound would be impossible to cleanly rule out in practice. Second, it allows us to remove expertise as a possible driver of diversification within industry. It furthermore allows us to study in a highly controlled environment the role of communication and their channels, as well as other mechanisms that may facilitate active common ownership of industry competitors. Lastly,

we posit that if non-professional experimental subjects understand the game played in the laboratory, it appears likely that professional managers do, too.

In our experimental base game, we assign the roles of managers and shareholders to four experimental subjects playing a duopoly game, which is akin to a prisoner's dilemma. Managers choose between a high (duopoly) quantity and a low (half monopoly) quantity. Acting in the interest of the firm (and undiversified shareholders of the firm) requires choosing the high duopoly quantity. Acting in the interest of shareholders that hold an equal stake in the competitor requires choosing the lower quantity. Before managers make production decisions, shareholders choose between a variety of compensation packages, which have the effect of incentivizing higher or lower production. Before that, undiversified shareholders have the option to offer to swap 50% of their shares with others; diversified shareholders similarly have the option to offer to concentrate their holdings in a similar firm.

To summarize our results, we find that in the absence of incentives, a large majority of 69% of the managers choose the high quantity and thus maximize their respective firm's profit. Further incentivizing the high quantity has no significant additional impact on production choices. However, we find that managers tend to act in the interests of their shareholders even if they do not have pecuniary incentives to do so. When managers receive fixed compensation, they are about 13% more likely to produce the low quantity if their shareholders are common (i.e. also hold shares in the competitor) as a opposed to separate owners. If managers' compensation plan incentives the low quantity, they are around 23% more likely to choose the low quantity, compared to the non-incentivized choice.

Shareholders, when choosing managerial compensation plans, take their own incentives (implied by their portfolio) as given, and tend to respond in a similarly systematic way to incentives. Diversified shareholders choose incentives that reward the internalization of product market externalities on the commonly-owned rival (i.e. low production choices). Concentrated shareholders tend to incentivize the high duopoly quantity.

Regarding the tendency for shareholders to diversify their portfolios in anticipation of

the incentive choice and product-market game that follows, we find that around 65% of shareholders choose to diversify in each round and ownership exchanges occur in 41% of the rounds. There is no trend towards more common ownership in later rounds as subjects gain experience. However, there is a strong default effect: If shareholders start off diversified, around 56% vote against exchanging shares and hence prefer to remain common owners and shareholders remain common owners in 83% of the rounds. This is an important result, because in financial markets outside the laboratory control, investors have various reasons unrelated to the potential to profit from anti-competitive behavior why they may own shares in competing firms, such as risk reduction from diversification or special knowledge about specific industries. Our results suggest that whatever the motives behind diversification in the field, an existing motive to reduce competition strengthens this tendency.

One hypothesis why not all separate shareholders vote to swap their shares and become common owners is uncertainty about the rationality of managers' behavior, as well as a failure by shareholders to anticipate that many managers do in fact adjust their behavior as a function of shareholders' portfolios. To test the hypothesis that strategic uncertainty inhibits strategic diversification, we run a variation of the baseline experiment in which managers are automated and always make the optimal choice given their incentives. We find that the results are unchanged. We interpret this as strategic uncertainty being less likely to be a major factor. Another possibility is that shareholders face cognitive limitations or a lack of empathy when it comes to imagining their future selves' strategic choices. They might also underestimate the strategic equilibrium response of their counterparts, as in Dal Bó et al., 2018, which might be mitigated when communication is allowed. Preliminary evidence from a small pilot suggests that communication may lead to more diversification but more data is needed to draw a conclusion.

Our paper is the first to examine whether and under which conditions the ability to reduce competition is a driving force for shareholders' portfolio choices. It relates to a literature in experimental industrial organization that deals with non-standard firm objectives,

reviewed by Armstrong and Huck (2010). To our knowledge, ours is the first such paper that explicitly considers how shareholders resolve the principal-agent problem with compensation contracts, and the first experimental corporate governance paper that features strategic firm interactions. Our paper also contributes to an empirical and theoretical literature on the competitive effects of "common ownership"; see Schmalz (2018, 2021) for reviews. The perhaps most closely related paper in that literature is Antón et al. (2018), who study theoretically and empirically how managerial compensation depends on common ownership. We address a key limitation of this literature, which thus far takes ownership to be an exogenous parameter, by studying how shareholders choose portfolios in anticipation of incentive setting and the product market game. Benndorf and Odenkirchen, 2021; Hariskos et al., 2022 study experimentally how exogenous changes in direct cross-ownership of one firm's shares by the firm's competitor changes competitive outcomes. This is conceptually distinct from our study of how ownership of competitor shares by industry outsiders affects competitive outcomes in the presence of a principal-agent problem between shareholders and managers. Piccolo and Schneemeier (2020) provide a theoretical model in which common ownership can arise endogenously. They prove that even risk-neutral investors will want to diversify, due to the competition-reducing effect; our paper shows experimentally that even when there is no risk experimental subjects choose to 'diversify'.

2 Experiment and Hypotheses

2.1 Experiment Design

Subjects participate in an experimental product market with 2 firms. Each market consisted of 4 subjects, two of which take the role of the managers and two of which take the role of the shareholders. The firms offer differentiated goods: an increase in production affects the firm's own price more than the competitor's price. Each market consists of 10 or 15 rounds, depending on the treatment, and the composition of market participants remains constant

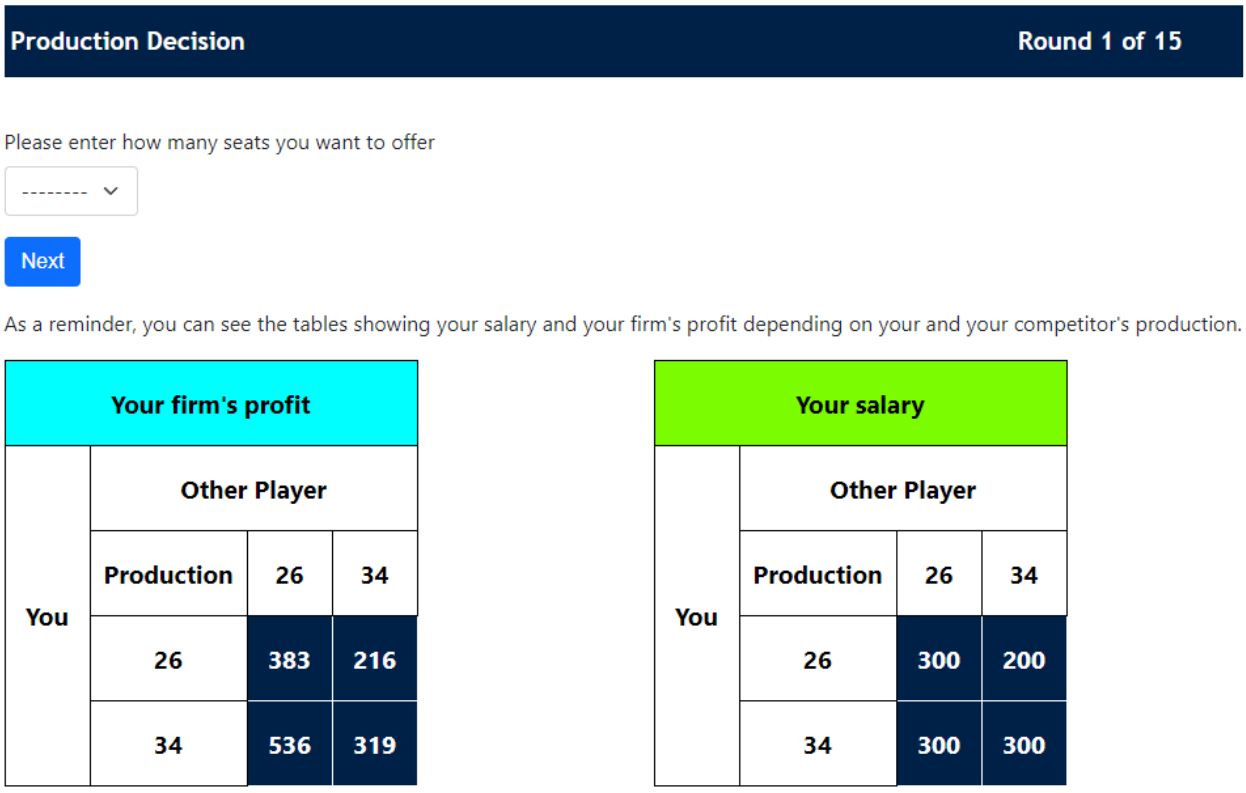
over all rounds. In each round the shareholders make two decisions. First, they decide the ownership structure of the firms, and second they incentivize the managers. The managers, in turn, choose the quantity that the respective firm produces. The payoff for the subjects that take the role of managers depends on the incentives chosen by the shareholders. The payoff of the shareholders depends on the profit of each firm in which they own shares. The firms are framed as airlines and the production choice is the number of seats that the airlines offer.

The production decision: In each round, the managers decide the quantity which the firm produces, either the duopoly equilibrium quantity (34), or half of the monopoly quantity (26). We impose this restriction because it simplifies the decision of the manager, as well as equilibrium calculation, as strategic delegation motives play no role. If managers try to maximize their firms' profit, producing the duopoly quantity is a dominant choice. If they instead want to maximize industry wide profits (which is in the best interest of the shareholders if they are common owners), producing half of the monopoly quantity is a dominant choice. Which choice maximizes the managers payoff depends on the incentives set by the shareholder.

The incentivization decision: In each round, shareholders set incentives for the managers. Each shareholder is always the "controlling shareholder" of one firm and her choices affect only the manager of that firm even if she owns shares of both firms. We test two different incentivization methods: ex ante incentive contracts and ex post bonus payments.

In the treatments that use ex-ante incentives, shareholders can choose between three possible incentive contracts: fixed incentives, relative profit incentives and relative margin incentives. With fixed incentives, the salary of the managers is independent of their production choice and the market outcome. With relative profit incentives, the managers earns a bonus if the profit of their firm is at least as high as the profit of the other firm. They can ensure that this is the case, regardless of the choice of the other manager, by producing the duopoly quantity. With relative margin incentives, managers get a bonus if their margin

Figure 1: Screenshot of production decision page



is at least as high as that of the other firm. Because the market has differentiated goods, producing a lower quantity than the competing firm leads to a higher price and since there are no variable costs the margin equals the price. Therefore, managers can ensure that their margin is at least as high as that of the other company by producing half of the monopoly quantity. That is, shareholders have full flexibility when deciding whether or not to incentivize their managers choice, and if yes which choice is incentivized. Managers observe their incentive contract before making their decision.

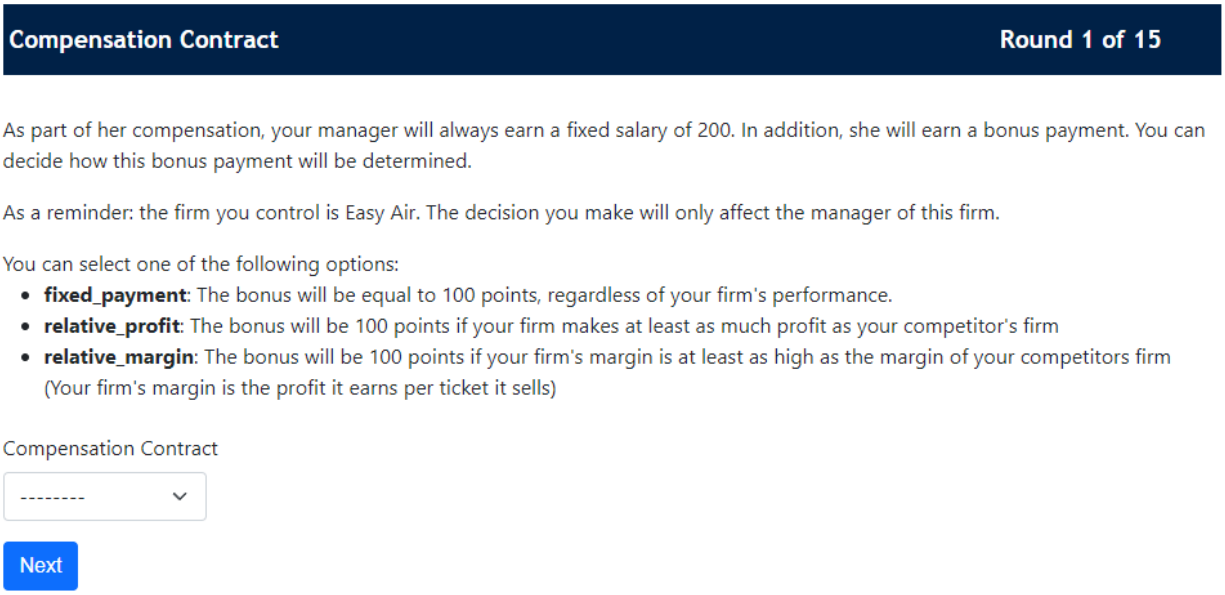
Since the payoff of the shareholders depends only on their own firms profit if they are separate owners and on the profit of both firms when they are common owners, they can align the incentives of their managers with their best interest by selecting relative profit incentives as separate owners and relative margin incentives as common owners.

In the ex post bonus treatment, shareholders can pay managers a bonus after observing their production choice. The bonus can be used as a reward for a manager's past performance.

Since groups remain constant throughout the experiment, this can influence the manager's future choices. The bonus payment can be anything between 0 and 100 points.

For both types of incentives the payment made to the manager does not come out of the firm's profit and hence does not affect the shareholders' payout directly. This was implemented to measure the shareholders' pure preferences over incentive mechanisms, unconfounded by selfish payoff considerations.

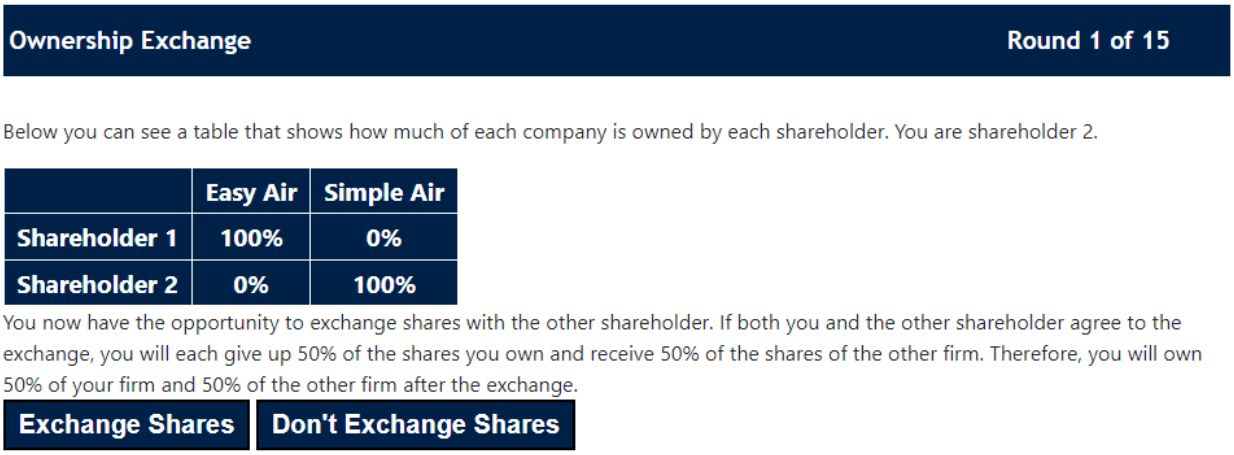
Figure 2: Screenshot of the ex ante incentive decision page



The diversification decision: In our baseline experiments, shareholders start each round as separate owners, each owning 100% of one of the firms and no shares in the other firm. They have the option to swap shares in order to become common owners, each owning 50% of both of the firms. If both shareholders agree to swap an exchange of ownership happens. Otherwise they remain separate owners. To test if the default matters for the final ownership structure, we run a treatment where shareholders start of as common owners and can swap shares in order to become separate owners. The diversification decision is always the first part of the experiment and both managers and shareholders observe the outcome of the diversification decision before making further choices. Shareholders can choose to diversify in order to incentivize their future selves to set relative margin incentives which

in turn incentives the managers to produce half of the monopoly. Provided that everyone follows their incentive in later stages, this leads to the monopoly outcome which yields the maximum payoff for the shareholders. If they do not diversify, it is in the best interest of their future selves to set relative profit incentives which incentivizes the managers to produce the high quantity. If everyone follows their incentives in later stages, this leads to the duopoly outcome which yields a lower shareholder profit than the monopoly outcome.

Figure 3: Screenshot of the diversification decision page



Communication:In one treatment, we also allow communication between shareholders and shareholders as well as between shareholders and managers. In this treatment, shareholders can chat for up to 3 minutes while making their diversification choice. Moreover shareholders can chat with the managers of the firms in which they own a stake for 3 minutes, before the managers make their production choice. Finally, we also allow managers and shareholders to read the communication between the other managers and shareholders.

2.2 Implementation

We run four main treatments. In treatment 1 shareholders start each round as separate owners and they can pay an ex post bonus. In treatment 2 shareholders start as separate owners and they can set ex ante incentive. In treatment 3 shareholders start as common owners and they can set ex ante incentives. Treatments 1-3 each had 15 rounds. Treatment

4 uses ex ante incentives and shareholders start diversified (like in Treatment 2). It also allows for communication and we reduced the number of rounds to 10. The experiment was implemented using oTree (Chen et al., 2016) and it uses an experimental currency called points, which is converted into real currency at the end of the experiment at a ratio that is known to subjects.

The sessions for treatments 1-3 were conducted online using the CESS subject pool of Nuffield College at the University of Oxford. The experiments were pre-registered (AEARCTR-0008810). Data for treatments 1 and 2 was collected between 11.02.2022 and 28.02.2022, using a total of 14 sessions, where each session contained subjects in both treatments. Data for treatment 3 was collected between 22.04.2022 and 13.06.2022 in a total of 11 sessions. The targeted number of subjects was 200 per treatment. In the end, 240 subjects completed treatment 1, 268 completed treatment 2 and 224 completed in treatment 3. The number of subjects who left the experiment after consenting to participate was 58, 57 and 66 in the three online treatments respectively. Because the experiment required 4 group members, each subject who left caused additional subjects to be unable to complete the experiment and due to subjects not showing up to the experiment some subjects could not start because no group was found for them. The reason why the number of subjects somewhat exceeds our target sample size of 200 is that we initially misjudged the share of subjects who dropped out and therefore over-recruited. Data for Treatment 4 was collected in the laboratory of the University of Cologne between 17.11.22 and 24.11.2022 in a total of 12 sessions. A caveat to all our results that compare treatment 4 (with communication) with the treatments without communication is that the subject pools (CESS Oxford vs. University of Cologne) as well as the way in which the experiment was conducted (Online vs in the Lab) differed between the treatments. Hence, any effect that we attribute to communication could also be attributed to the differences in subject pools or in the difference between online and offline experiments [2].

[2]We had to rely on different subject pools because the large number of observations (over 800 across the four main treatments) was beyond the capacity of any individual lab. The move from an online to a lab

2.3 Hypotheses

In this section, we state our hypotheses. In general we hypothesize that subjects follow their incentives and set incentives anticipating that their future selves and the other subjects also follow incentives. Hence we assume that agents are rational and know that everyone else is rational. However, we do not need to assume that agents know that other agents know that they are rational and hence our assumption is weaker than common knowledge of rationality.

Following the logic of backwards induction, we start by considering the the production decision of the managers:

Hypothesis 1 (Production Decisions with Incentives)**.** *Managers tend to choose dominant strategies when they available*

Dominant strategies are available if the managers is incentivised with relative margin incentives (low quantity is dominant) and if the managers is incentivised with relative profit incentives (high quantity is dominant). If the manager has fixed incentives instead, there are no dominant choices and we have 3 competing hypotheses for the behavior of the managers:

Hypothesis 2 (Production Decisions without Incentives)**.**

Hypothesis 2a. *When managers receive the same payoff for both production options they randomize*

Hypothesis 2b. *When managers receive the same payoff for both production options they choose the option that is in the best interest of their shareholder(s)*

Hypothesis 2c. *When managers receive the same payoff for both production options they choose the option that maximizes the profit of the firm they manage*

Hypothesis 2a follows from the assumption that managers are indifferent between the choices if their payoff does not depend on the decision and hence choose at random. However, may also feel an intrinsic motivation to act in the best interest of their shareholders,

experiment was done, because we always planned to run lab experiments due to the complexity of the task and the higher rate of dropouts in online experiments which was a severe issue in our online treatments. Due to the Covid 19 pandemic we had to move our initial sessions online as laboratories were closed.

whose profit depends on their choices, which leads to Hypothesis 2b. This could by driven by social preferences such as altruism or efficiency concerns. Finally, managers may also want to maximize the profit of their firm even if this does not benefit any subject in the experiment (Hypothesis 2c). This may for example be the case because they gain utility from outperforming the other firm.

Figure 4: Firm's individual and combined profits depending on the production decisions

Profit of a firm			
The Firm	The Competing Firm		
	Production	26	34
	26	383	216
	34	536	319

Profit of both firms Combined			
Firm 1	Firm 2		
	Production	26	34
	26	766	752
	34	752	638

Next we turn to the decision of shareholders. Figure 4 shows the profits of a firm and the profit of both firms combined, depending on the production choices of both firms. Both tables in the figure are taken from the instructions of the experiment. We can see that with separate ownership, shareholders are in a prisoners dilemma like situation. Incentivizing the manager to choose the high quantity (34) is the equilibrium strategy but profit if both firms produce the high quantity is lower than if both firms produce the low quantity. In contrast, with common ownership the equilibrium strategy is to incentive the manager to produce the low quantity (26), which leads to higher industry wide profit and higher profits for the shareholders. This leads us to the next hypothesis:

Hypothesis 3 (Shareholders' choice of ex ante incentives)**.** *Common ownership shareholders incentivize monopolization, separate ownership shareholders incentivize competition.*

With ex ante incentives, this hypothesis implies that shareholders choose relative profit

incentives if they are separate owners and relative margin incentives if they are common owners. With ex post bonus incentives there are many equilibria depending on which strategies the managers play when setting their bonus and how managers react to a bonus. One plausible combination of strategies is that shareholders pay a high bonus if managers made the optimal choice given their diversification contract (i.e. they reward past performance) and that shareholders are also backwards looking and are more likely to stick to their choice if they got a higher bonus. This implies that shareholders should pay a high bonus if they are common owners and the manager produced the low quantity or if they are separate owners and the manager produced the low quantity and a low bonus otherwise.

Next, we turn to the diversification decision. We have analyzed before that the shareholders payoff is higher, if she is a common owner and sets relative profit incentives than if she is a separate owner and sets relative margin incentives. Hence, if she beliefs that the other shareholder will vote to exchange shares, the best response is to also vote to exchange shares. However, if she thinks the other shareholder will not vote to exchange shares, there will be no exchange of shares regardless of her choice, which makes both voting to exchange shares and not voting to exchange shares a best response. Hence, there are two equilibria, one were both shareholders vote to exchange shares and one were both shareholders vote not to exchange shares, which leads us to the two hypotheses:

Hypothesis 4 (Shareholders' choice of ownership)**.**

Hypothesis 4a. *Forward-looking shareholders tend to choose payoff-dominant (common ownership) equilibrium.*

Hypothesis 4b. *Backward-looking shareholders tend to choose the equilibrium given by the default ownership.*

Finally, we turn to the communication treatment. Existing evidence suggests that communication may help shareholders to coordinate on the payoff dominant equilibrium (Cooper

et al., 1992) but that the effectiveness depends on the type of game and the type of communication. We hypothesize:

Hypothesis 5 (Communication)**.** *Communication reduces coordination failure in the choice of ownership, leading to more common ownership.*

3 Results

3.1 Descriptive Statistics

In this section, we present the results of our experiment. Table 1 shows descriptive statistics. The percentage of shareholders who vote to exchange shares is roughly two third in the two treatments were shareholders start as separate owners and cannot communicate. Interestingly, it is also around 43% in treatment 2 were shareholders start as common owners. Since actively choosing common ownership means voting to exchange in the treatment with divided default and not voting to exchange in the treatment with common default, this result implies that only 57% of subjects actively choose common ownership with the common default, which is less than the roughly 66% with the divided default. However, because both shareholders need to agree to an exchange, coordination failure favors the default. Therefore, the fraction of shareholders who actually are common owners is much higher in treatment 3 (83%) compared to treatment 1 (45%) and treatment 2 (40%). In treatment 4 (with communication), the fraction of shareholders who vote to be common owners is highest (76%) and exchange occurs in two thirds of the cases. As expected, the share of subjects that produce the low quantity is always higher when shareholders are common owners but the differences are relatively small. In the treatments without communication, the share is between 40% and 50% with common ownership and around 30% without common ownership. Communication strongly increases the share with which the low quantity is produced regardless of diversification status. This suggests that it facilitates collusion between firms in a manner that is additive to the effect of common ownership. In line with hat shareholder profits are

clearly larger with communication than without.

Table 1: Descriptive Statistics

	T1		T2		T3		T4	
Share Voted Exchange	68.39%		64.38%		43.81%		75.92%	
Share Exchange Occurred / Not Occurred	45.33%	54.67%	40.1%	59.9%	17.38%	82.62%	66.33%	33.67%
Share (Fixed, Profit, Margin) Incentives	-	-	19.6%, 34.74%, 45.66%	24.58%, 39.45%, 35.96%	22.26%, 38.36%, 39.38%	17.44%, 35.09%, 47.48%	42.15%, 31.08%, 26.77%	26.06%, 44.24%, 29.7%
Share Low Quantity	48.65%	30.49%	48.88%	34.05%	29.11%	40.85%	80.46%	66.67%
Manger Bonus	33.89		-		-		-	
Manger Salary	233.89		286.97		289.88		342.65	
Shareholder Profit	258.07		259.29		256.19		293.51	
Number Of Subjects	240		268		224		196	

3.2 Results without Communication

We start our analysis by focusing on the treatments without communication. According to Hypothesis 1, managers should choose dominant strategies when they are available, that is they should produce the low quantity when they have relative margin incentives and the high quantity when they have relative profit incentives. We test this by running the regression:

$$low\,production = \beta_1 + \beta_2 relative\,profit + \beta_2 relative\,margin \tag{1}$$

Table 2: Production Decisions & Incentives - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.3088***	0.2797***	0.4107***
	(SD=0.0262)	(SD=0.0679)	(SD=0.0737)
	(p<0.001)	(p<0.001)	(p<0.001)
Relative Profit	-0.0304	-0.0246	-0.0342
	(SD=0.0300)	(SD=0.0292)	(SD=0.0296)
	(p=0.311)	(p=0.401)	(p=0.249)
Relative Margin	0.2271***	0.2293***	0.2231***
	(SD=0.0337)	(SD=0.0332)	(SD=0.0335)
	(p<0.001)	(p<0.001)	(p<0.001)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0622	0.0912	0.0947
N	3690	3690	3690

The table shows the result of a regression of a dummy that is 1 if a manager produced the low quantity and 0 otherwise on a dummy that is 1 if the manager was paid with relative profit incentives ad 0 otherwise and a dummy that is 1 if the manager was paid with relative margin incentives and 0 otherwise. The baseline in this regression is a manager with fixed incentives. Standard errors are clustered on the subject level.

Table 2 shows the results of the regression. Since the dependent variable is a dummy, the regression is a linear probability model and the coefficients can be interpreted as probabilities

with the caveat that a linear probability model can predict probabilities above one. The results suggests that managers are around 3% less likely to produce the low quantity when they are incentivized with relative profit incentives compared to fixed incentives, but the coefficients are not significant. However, they are between 20.55% and 23.32% more likely to choose the low quantity when they are incentivized with relative margin incentives compared to fixed incentives. All coefficients are significant at the 1% level. The fact that relative profit incentives have no significant effect on production could be because the majority of managers already choose the high quantity in the absence of incentives so that adding further incentives to do so do not impact their decision. This result partially confirms and partially rejects Hypothesis 1.

To study the link between incentives and production decision in the bonus treatment, we regress a dummy that is 1 if the manager changed the quantity she produced in round t relative to round $t-1$ ($changed\,production_t$) on the bonus paid to the manager in round $t-1$.

$$changed\,production_t = \beta_1 + \beta_2 bonus_{t-1} \tag{2}$$

Table 3 shows that managers between 0.1% and 0.12% less likely to change their production decisions for each additional point of bonus payment they receive. Since shareholders can vary their bonus payment by 100 points, they can achieve an influence of between 10% and 12%. This suggests that they are able to incentivize managers to act in their best interest, by paying a low bonus if the manager makes a production choice which is not in their best interest and a high bonus if the manager makes a production choice that is in their best interest.

Next, we test the three competing Hypotheses 2, by running the following regression using only data from decisions where the manager had fixed incentives:

$$low\,production = \beta_1 + \beta_2 common\,ownership \tag{3}$$

Table 3: Production Decisions & Incentives - Treatment 1

	(1)	(2)	(3)
Constant	0.3537***	0.4857***	0.4521***
	(SD=0.0272)	(SD=0.0702)	(SD=0.0657)
	(p<0.001)	(p<0.001)	(p<0.001)
Bonus Last Round	-0.0010**	-0.0012**	-0.0012**
	(SD=0.0005)	(SD=0.0005)	(SD=0.0005)
	(p=0.048)	(p=0.028)	(p=0.033)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0046	0.0161	0.0146
N	1680	1680	1680

The table shows the result of a regression of a dummy that is 1 if a manager changed the produced quantity in round t relative to round t-1 and 0 otherwise on the bonus paid to the manager in round t-1. Standard errors are clustered on the subject level.

Table 4 shows that the managers choose lower quantities when their shareholders are diversified, in the absence of incentives to do so, which is in line with 2b. Moreover, the constant is below 0.5 in all specifications suggesting that shareholders favor the choice that maximizes the profit of their own firm. This supports Hypothesis 2c and together the results clearly reject Hypothesis 2a that choices are random in the absence of incentive.

Next we test Hypothesis 3 by analyzing the incentive decisions of the shareholders for the treatments with ex ante incentives (Treatments 2 & 3). We run the following regression:

$$anticompetitiveness\,of\,incentives = \beta_1 + \beta_2 common\,ownership \tag{4}$$

Where $anticompetitiveness\,of\,incentives$ is a categorical variable that is 1 if the shareholder set relative profit incentives, 0 if the shareholder set fixed incentives and -1 if the shareholder set relative margin incentives. The more positive the variable the stronger do the incentives reward the managers for producing the high quantity.

Table 4: Production and ownership structure

	(1)	(2)	(3)
Constant	0.2521***	0.2463***	0.4163***
	(SD=0.0365)	(SD=0.0773)	(SD=0.1362)
	(p<0.001)	(p=0.001)	(p=0.002)
CommonOwnership	0.1079**	0.1309***	0.1254***
	(SD=0.0468)	(SD=0.0441)	(SD=0.0451)
	(p=0.021)	(p=0.003)	(p=0.005)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0123	0.1084	0.1065
N	761	761	761

The table shows the result of a regression of a dummy that is 1 if the manager produced the low quantity ad 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. The regression only uses data from decisions where the manager had fixed incentives. Standard errors are clustered on the subject level.

Table 5 shows that common owners are significantly more likely to set incentives that encourage lower production relative to separate owners in line with Hypothesis 3. However, the effect size is not very large. In Appendix C we take a more detailed look by running three separate regressions using a dummy that is one if the shareholder chose relative profit, fixed and relative margin incentives respectively on a dummy that is one if the shareholder was diversified and zero otherwise. We find no clear impact of diversification status on relative profit and fixed incentives, but find that shareholders are significantly more likely to choose relative margin incentives and hence incentivize the manager to produce the low quantity when they are diversified and the effect size is around 9%. Overall the results from these regressions show that on average managers set the correct incentives but there is significant heterogeneity. In a world were all shareholders play the equilibrium strategy, shareholders would exclusively choose relative profit incentives if they are separate owners and exclusively choose relative margin incentives when they are common owners, which would lead to an

Table 5: Incentives and ownership structure - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.0261	0.0047	0.1715
	(SD=0.0408)	(SD=0.1088)	(SD=0.1221)
	(p=0.523)	(p=0.966)	(p=0.160)
CommonOwnership	-0.1446***	-0.1299**	-0.1473***
	(SD=0.0511)	(SD=0.0540)	(SD=0.0550)
	(p=0.005)	(p=0.016)	(p=0.007)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0061	0.0160	0.0162
N	3690	3690	3690

The table shows the result of a regression of a variable that is one if a shareholder set relative profit incentives, 0 if she set fixed incentives and -1 if she set relative margin incentives on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. Standard errors are clustered on the subject level

effect size of 2 in the regression of the combined incentive dummy on the common ownership dummy and a coefficient of 1 in the regression of the relative margin dummy on the common ownership dummy.

Next, we study how the ex post bonus payments of the shareholder are linked to the managers behavior by running the following regression.

$$bonus = \beta_1 + \beta_2 common\ ownership + \beta_2 low\ production + \beta_3 common\ ownership\ X\ low\ production \quad (5)$$

In the regression equation, *bonus* is the ex post bonus payment of the shareholder to the manager, *common ownership* is a dummy that is 1 if the shareholder was a common owner and 0 otherwise and *low production* is a dummy that is 1 if the manager produced

Table 6: Incentives and ownership structure - Treatment 1

	(1)	(2)	(3)
Constant	34.0789***	48.0628***	52.5396***
	(SD=2.9323)	(SD=7.6220)	(SD=7.7783)
	(p<0.001)	(p<0.001)	(p<0.001)
CommonOwnership	-3.0694	-0.0818	-0.2779
	(SD=3.1256)	(SD=2.9123)	(SD=2.9614)
	(p=0.326)	(p=0.978)	(p=0.925)
Low Production	-9.7923***	-13.3889***	-13.8968***
	(SD=3.5706)	(SD=3.7829)	(SD=3.8192)
	(p=0.006)	(p<0.001)	(p<0.001)
Low Production X Common Ownership	22.6266***	24.5207***	24.8378***
	(SD=5.3281)	(SD=5.0700)	(SD=5.1533)
	(p<0.001)	(p<0.001)	(p<0.001)
Low Production + Low Production X Common Ownership	12.8343***	11.1319***	10.9410**
	(SD=4.2887)	(SD=4.2595)	(SD=4.2961)
	(p=0.003)	(p=0.009)	(p=0.011)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0349	0.1131	0.1121
N	1800	1800	1800

The table shows the result of a regression of the bonus paid by the shareholder to the manager on a dummy that is 1 if the shareholder was a common owner and 0 otherwise, a dummy that is 1 if the manager produced the low quantity and an interaction term. Standard errors are clustered on the subject level.

the low quantity and 0 otherwise. Table 6 shows the regression results. The coefficient of *low production* measures the effect of a manager's choice to produce the low quantity on the bonus, if her shareholder is a separate owner. This coefficient is negative and highly significant. Given that the average bonus payment is 35 an effect size of between -9.8 and -13.9 also matter economically. The effect of a low production for common owners is the sum of the coefficient of *low production* and the coefficient of the interaction term *common ownership X low production*. The coefficients are positive with effect sizes between 10.9 and 12.8 and they are significant in all specifications. This suggests that shareholders reward behavior that was in their best interest in the ex post bonus treatment.

Finally, we test the two competing Hypotheses 4a and 4b, by regressing a dummy that is 1 if a shareholder voted to exchange shares on just a constant. We use this method instead of a simple t-test because it allows us to cluster standard errors at the subject level. The

constant has a coefficient of 0.66 and is significantly different from 0.5 ($p < 0.01$). This suggests that more than half of the shareholders shareholders want to diversify, which allows them to reach the payoff dominant equilibrium in line with 4a. However, a large minority of subjects also sticks to the default in line with 4b.

One reason why shareholders may stick to the default is that they have never experienced common ownership and that they are unable to recognize the potential benefits of common ownership without experience. To study this we test if shareholders are more likely to vote to exchange shares again if they experienced common ownership by running the following regression:

$$voted\,exchange_{i,t} = \beta_1 + \beta_2 voted\,exchange_{i,t-1} + \beta_3 exchange\,occurred_{i,t-1} \tag{6}$$

In the regression, i denotes a shareholder and t denotes a round. *vote exchange* is a dummy that is one if a shareholder voted to exchange shares and zero otherwise. *exchangeoccurred* is a dummy that is one if an exchange actually occurred (i.e. both shareholders in a group voted to exchange in a given round) and zero otherwise. Table 7 shows the result of the regression. Since all variables in the model are dummies we have a linear probability model in which the coefficients of the independent variables can be interpreted as probabilities. The results suggest that a subject that voted to exchange shares in a round are around 42% more likely to vote to exchange shares again. However when an exchange of ownership actually occurred, shareholders are 5% less likely to vote to exchange again. The coefficient is however not significant without fixed effects and only marginally significant with session and round fixed effects. Overall, these results support the conclusion that some subjects have a preference to exchange shares and others have a preference not to exchange shares, but experiencing common ownership does not convince shareholders of its benefits and if anything makes them less likely to want to be common owners again.

Table 7: Exchange decisions across rounds - Treatment 1 & 2

	(1)	(2)	(3)
Constant	0.4034***	0.3732***	0.5185***
	(SD=0.0214)	(SD=0.0523)	(SD=0.0598)
	(p<0.001)	(p<0.001)	(p<0.001)
$Voted\ Exchanged_{t-1}$	0.4172***	0.4155***	0.4166***
	(SD=0.0287)	(SD=0.0285)	(SD=0.0284)
	(p<0.001)	(p<0.001)	(p<0.001)
$Exchange\ Occurred_{t-1}$	-0.0401*	-0.0542**	-0.0534**
	(SD=0.0226)	(SD=0.0229)	(SD=0.0238)
	(p=0.076)	(p=0.018)	(p=0.025)
$Session\ Fixed\ Effects$	no	yes	yes
$Round\ Fixed\ Effects$	no	no	yes
$Adjusted\ R^2$	0.1539	0.1579	0.1646
N	3809	3809	3809

The table shows the result of a regression of a dummy that is 1 if a shareholder voted to exchange shares in a given round and 0 otherwise, on a dummy that is 1 if a shareholder wanted to exchange shares in the previous round and 0 otherwise as well as a dummy that is 1 if an exchange of ownership occurred in the previous round and 0 otherwise. Standard errors are clustered on the subject level.

3.3 Results with Communication

Next, we test if communication can help shareholders to coordinate on the payoff dominant equilibrium by running the following regression.

$$voted\ exchange_{i,t} = \beta_1 + \beta_2 Communication_i \tag{7}$$

In the regression, i denotes a shareholder and t denotes a round. *vote exchange* is a dummy that is one if a shareholder voted to exchange shares and zero otherwise and *Communication* is a dummy s one if a shareholder was in the communication treatment and zero otherwise.

Table 8: Exchange Decisions on Communication - Treatment 1, 2 & 4

	(1)	(2)
Constant	0.6627***	0.7719***
	(SD=0.0180)	(SD=0.0245)
	(p<0.001)	(p<0.001)
Communication	0.0965***	0.0848**
	(SD=0.0345)	(SD=0.0346)
	(p=0.005)	(p=0.014)
Round Fixed Effects	no	yes
Adjusted R^2	0.0068	0.0107
N	4790	4790

The table shows the result of a regression of a dummy that is one if a shareholder voted to exchange shares in a given round, on a dummy that is one if a shareholder was in the communication treatment and zero otherwise. Standard errors are clustered on the subject level.

We can see that in line with Hypothesis 5, shareholders are more likely to want to exchange shares when they are allowed to communicate.

In the following part of this section we test how communication interacts with the production decision of the managers, the incentive decision of the shareholders and the effect of experiencing common ownership on the decision to vote to exchange, analogous to the analysis in Section 3.2.

First, we examine the interaction between communication and incentive contracts on the managers production choices. As expected based on the descriptive statistics, the main effect of communication on the probability is positive and has a large effect size of more than 40% in all specifications. The interaction between the relative profit dummy and communication is negative in all treatments but only significant without fixed effects. Hence, no firm conclusion can be drawn but if taken at face value the evidence suggests that communication supports the impact of this incentive contract, as relative profit incentives incentivize the managers to

Table 9: Production Decisions & Incentives - Treatment 2, 3 & 4

	(1)	(2)	(3)
Constant	0.3088***	0.2797***	0.3563***
	(SD=0.0262)	(SD=0.0680)	(SD=0.0723)
	(p<0.001)	(p<0.001)	(p<0.001)
Relative Profit	-0.0304	-0.0246	-0.0300
	(SD=0.0300)	(SD=0.0293)	(SD=0.0295)
	(p=0.311)	(p=0.401)	(p=0.310)
Relative Margin	0.2271***	0.2293***	0.2258***
	(SD=0.0337)	(SD=0.0332)	(SD=0.0335)
	(p<0.001)	(p<0.001)	(p<0.001)
Communication	0.4829***	0.4122***	0.4098***
	(SD=0.0474)	(SD=0.0712)	(SD=0.0717)
	(p<0.001)	(p<0.001)	(p<0.001)
Relative ProfitXCommunication	-0.1435**	-0.0774	-0.0831
	(SD=0.0661)	(SD=0.0608)	(SD=0.0609)
	(p=0.030)	(p=0.203)	(p=0.173)
Relative MarginXCommunication	-0.1254**	-0.1042**	-0.1037**
	(SD=0.0533)	(SD=0.0510)	(SD=0.0513)
	(p=0.019)	(p=0.041)	(p=0.043)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.1451	0.1847	0.1851
N	4670	4670	4670

The table shows the result of a regression of a dummy that is 1 if a manager produced the low quantity and 0 otherwise on a dummy that is 1 if the manager was paid with relative profit incentives ad 0 otherwise and a dummy that is 1 if the manager was paid with relative margin incentives and 0 otherwise, as well as a dummy that is 1 if the manager was in the communication treatment and 0 otherwise and interaction terms between the communication dummy and the other independent variables. The baseline in this regression is a manager with fixed incentives. Standard errors are clustered on the subject level.

produce the high quantity. In contrast, communication seems to partially replace the relative margin incentives which have a significantly smaller positive effect on the probability that the low quantity is chosen with communication than without communication. This can be explained by the fact that mangers are much more likely to produce the low quantity without incentives in the communication treatment, which leaves less room for an impact of

incentives.

Table 10: Production and ownership structure

	(1)	(2)	(3)
Constant	0.2521***	0.2463***	0.3469***
	(SD=0.0365)	(SD=0.0773)	(SD=0.1133)
	(p<0.001)	(p=0.001)	(p=0.002)
CommonOwnership	0.1079**	0.1309***	0.1292***
	(SD=0.0468)	(SD=0.0441)	(SD=0.0445)
	(p=0.021)	(p=0.003)	(p=0.004)
Communication	0.3991***	0.3199***	0.3248***
	(SD=0.0932)	(SD=0.0924)	(SD=0.0947)
	(p<0.001)	(p<0.001)	(p<0.001)
CommonOwnershipXCommunication	0.0767	-0.0541	-0.0574
	(SD=0.0956)	(SD=0.0763)	(SD=0.0772)
	(p=0.422)	(p=0.479)	(p=0.457)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.2182	0.3378	0.3390
N	1121	1121	1121

The table shows the result of a regression of a dummy that is 1 if the manager produced the low quantity and 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. The regression only uses data from decisions where the manager had fixed incentives, as well as a dummy that is 1 if the manager was in the communication treatment and 0 otherwise and interaction terms between the communication dummy and the other independent variables. Standard errors are clustered on the subject level.

Interestingly, communication significantly increases the probability that managers produce the low quantity in the absence of incentives (Table **??**) and the effect size is large ranging from 32% to 40%. However, there is no interaction between common ownership and communication. This suggests that shareholders do not use communication to explain to the managers which production choice is in their best interest but instead they seem to influence managers to produce the lower quantity regardless of diversification status.

Turning to the shareholders choice of incentive contracts, Table 11 suggests that there is neither a direct effect of communication on the shareholders choice to incentivise low production nor is there an interaction between communication and common ownership.

Table 11: Incentives and ownership structure - Treatment 2,3 & 4

	(1)	(2)	(3)
Constant	0.0261	0.0047	0.1938
	(SD=0.0408)	(SD=0.1089)	(SD=0.1179)
	(p=0.523)	(p=0.966)	(p=0.100)
CommonOwnership	-0.1446***	-0.1299**	-0.1484***
	(SD=0.0511)	(SD=0.0540)	(SD=0.0548)
	(p=0.005)	(p=0.016)	(p=0.007)
Communication	0.1194	0.1142	0.0909
	(SD=0.0918)	(SD=0.1223)	(SD=0.1220)
	(p=0.193)	(p=0.350)	(p=0.456)
CommonOwnershipXCommunication	0.0422	0.0679	0.0860
	(SD=0.1076)	(SD=0.1026)	(SD=0.1022)
	(p=0.695)	(p=0.508)	(p=0.400)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0094	0.0291	0.0305
N	4670	4670	4670

The table shows the result of a regression of a variable that is one if a shareholder set relative profit incentives, 0 if she set fixed incentives and -1 if she set relative margin incentives on a dummy that is 1 if the shareholder was a common owner and 0 otherwise, as well as a dummy that is 1 if the shareholder was in the communication treatment and 0 otherwise and interaction terms between the communication dummy and the other independent variables. Standard errors are clustered on the subject level

Finally, we study how communication interacts with the impact of experiencing an ownership exchange on the decision of the shareholders to diversify again. Without communication, experiencing an ownership exchange slightly reduces the probability of voting for an exchange again by roughly 5%. However, with communication subjects are significantly more likely to vote to exchange again when they experienced an exchange relative to the baseline without communication. In the communication treatment experiencing an exchange makes shareholders approximately 11% more likely to vote for an exchange again.

Table 12: Exchange decisions across rounds - Treatment 1, 2 & 4

	(1)	(2)	(3)
Constant	0.4034***	0.3732***	0.5006***
	(SD=0.0214)	(SD=0.0524)	(SD=0.0582)
	(p<0.001)	(p<0.001)	(p<0.001)
$Voted\ Exchanged_{t-1}$	0.4172***	0.4155***	0.4165***
	(SD=0.0286)	(SD=0.0285)	(SD=0.0284)
	(p<0.001)	(p<0.001)	(p<0.001)
$Exchange\ Occurred_{t-1}$	-0.0401*	-0.0542**	-0.0542**
	(SD=0.0226)	(SD=0.0229)	(SD=0.0236)
	(p=0.076)	(p=0.018)	(p=0.022)
Communication	-0.0094	0.0305	0.0197
	(SD=0.0535)	(SD=0.0664)	(SD=0.0649)
	(p=0.861)	(p=0.647)	(p=0.762)
$Voted\ Exchanged_{t-1}XCommunication$	-0.0346	-0.0475	-0.0536
	(SD=0.0804)	(SD=0.0795)	(SD=0.0790)
	(p=0.666)	(p=0.551)	(p=0.498)
$Exchange\ Occurred_{t-1}XCommunication$	0.1525***	0.1546***	0.1643***
	(SD=0.0584)	(SD=0.0578)	(SD=0.0593)
	(p=0.009)	(p=0.007)	(p=0.006)
$Exchange\ Occurred_{t-1}\ +\ Exchange\ Occurred_{t-1}XCommunication$	0.1125**	0.1004*	0.1101**
	(SD=0.0538)	(SD=0.0530)	(SD=0.0542)
	(p=0.037)	(p=0.058)	(p=0.042)
$Session\ Fixed\ Effects$	no	yes	yes
$Round\ Fixed\ Effects$	no	no	yes
$Adjusted\ R^2$	0.1736	0.1774	0.1824
N	4788	4788	4788

The table shows the result of a regression of a dummy that is one if a shareholder voted to exchange shares in a given round and zero otherwise, on a dummy that is one if a shareholder wanted to exchange shares in the previous round and zero otherwise as well as a dummy that is one if an exchange of ownership occurred in the previous round and zero otherwise, as well as a dummy that is one if the shareholder was in the communication treatment and zero otherwise and interaction terms between the communication dummy and the other independent variables. Standard errors are clustered on the subject level.

4 Conclusion

Market economies rely on incentives to compete to deliver their promise – welfare. This experiment showed a mechanism by which market participants themselves get rid of incentives to compete. The fact that a significant share of non-professional experimental subjects are able to "figure out" how to use the stock market to remove incentives to compete within a few rounds of play – in some cases with each others' help – makes it very likely that professional managers would likewise be able to turn the competitive stock market into a

"cartel maker," as economists have warned since four decades ago (Rubinstein and Yaari, 1983).[3] Whereas a benign motive to diversify risk could also have the effect of removing firms' incentives to compete (Rotemberg, 1984), the experiment shows that there exists another motive to diversify across product market rivals: the removal of competitive incentives. Hence, policy makers should not assume that the only way to restore competitive incentives is to restrict passive investment choices. Instead, policy makers should take note of active monopolizations of industries masquerading as benign diversification.

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A Exogenous Ownership and Incentives

Before our experiments in which we endognize ownership and incentive structure we ran a set of pilots that are pre-registered as AEARCTR-0006817. The pilots were conducted online on Prolific between December 10th 2020 and January 5th 2021. After observing the pilots results, we decided not to continue with the main study because at this point we came to the conclusion that the results from our planned study with endogenous incentives and ownership could also be used to test the impact of incentives and a ownership structure on manager behavior. In this section we result the reports of the pilot. In total we ran six pilot treatments, which varied ownership structure (separate or common ownership) and manager incentives (fixed payment, participation in the firms profit, participation in the profit of both firms). Letting managers participate in their own Firm's profit makes maximizing their firms profit by producing the high quantity the dominant choice and letting managers participate in the profit of both firms makes maximizing the combined profit if both firms by producing the low quantity the dominant choice. Unlike in later experiments, the salary of the managers was deducted from the profits of the firms before the shareholders' profits were calculated.

Table 13 shows the share of decisions in which the low quantity was chosen as well as the average shareholder profit. Four facts about the production decisions emerge. First, in the absence of incentives: common ownership leads to a slightly higher share of low productions. Second, managers respond to incentives Setting incentives to maximize the own firm's own profit lead to a slightly lower share of low quantity choices and setting incentives to maximize the combined profit of both firms leads to a significantly higher share of low production choices. Third, managers have a preference to maximize their own firms profit in the absence of incentives and even with opposing incentives almost half of them choose to do so. Fourth, incentives dominate the direct effect of common ownership. With incentives there is no clear difference in the share with with the low quantity is chosen between the two ownership structures.

Table 14 shows pairwise fisher tests for differences in the share of decisions to produce the low quantity. The results confirm that the four facts discussed above are statistically significant. Only the difference between separate ownership with fixed incentives compared to incentives to maximize the firms own profit is only marginally significant. Overall these results are in line with the results form the data with endogenous incentives where we also find that managers tend to produce the lower quantity more often if their shareholders are common owners as opposed to separate owners and that producing the high quantity seems to be the default choice for most managers, so that incentives to produce the high quantity

Overview of Exogenous Ownership & Incentives Treatments

	Separate Ownership	Common Ownership
Fixed Incentives	Pilot Treatment 1	Pilot Treatment 2
% of Own Firm's Profit	Pilot Treatment 3	Pilot Treatment 4
% of Both Firms' Profit	Pilot Treatment 5	Pilot Treatment 6

Table 13: Production Decisions

Pilot Treatment	Share 25	N
1	23.48%	460
2	30.47%	640
3	18.41%	440
4	20.67%	600
5	57.37%	380
6	53.4%	500

Table 14: Production Decisions - Pairwise Significance Tests

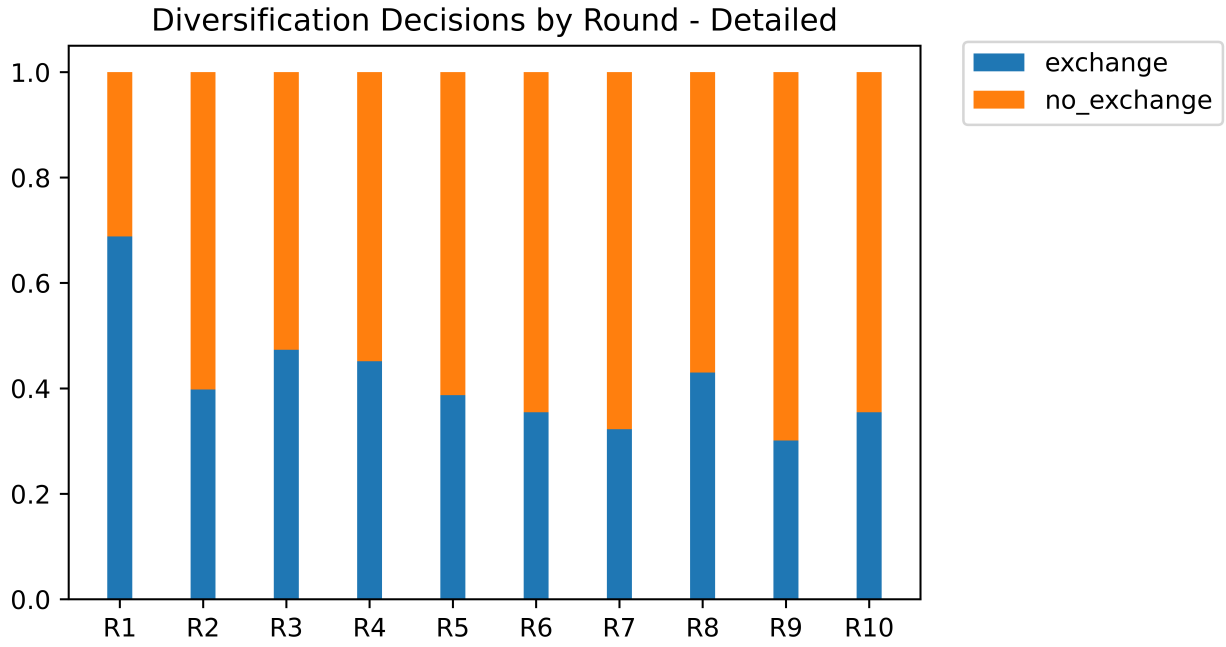
	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6
T 1	-	-0.0699**	0.0507*	0.0281	-0.3389***	-0.2992***
T 2	0.0699**	-	0.1206***	0.0980***	-0.2690***	-0.2293***
T 3	-0.0507*	-0.1206***	-	-0.0226	-0.3896***	-0.3499***
T 4	-0.0281	-0.0980***	0.0226	-	-0.3670***	-0.3273***
T 5	0.3389***	0.2690***	0.3896***	0.3670***	-	0.0397
T 6	0.2992***	0.2293***	0.3499***	0.3273***	-0.0397	-

have a much smaller effect than incentives to produce the low quantity.

B Automated Managers

While we show in Section 3 that shareholders are able to incentivize the managers to act in their best interest, there is still significant noise in the behavior of managers. For instance, in the ex ante incentive treatment, managers should exclusively produce the low quantity if they have relative margin incentives and exclusively produce the high quantity if they have relative profit incentives. Table 2 suggests that the influence of incentives is not this strong. If managers do not fully respond to incentives this decreases the benefits of diversification for the shareholder and could explain why they do not choice to diversify. To test this we run a fourth treatment of the experiment where shareholders set ex ante incentives and managers are automated and always make the choice that maximizes their salary. This means that if they are incentivized with relative profit incentives, they will always produce the high quantity, if they are incentivized with relative margin incentives, they will always produce the low quantity and if they are incentivized with fixed incentives they are indifferent and therefore randomize between producing the low quantity and the high quantity. Shareholders start as separate owners and can exchange shares to become common owners if they both agree. The experiment was run online on the platform Prolific on 09.11.2022.

Figure 5: Exchange Outcome - Treatment 4



5 shows the diversification decisions over time. We can see that the marker still does not converge towards common ownership. If anything fewer shareholders vote to exchange shares over time. Therefore, uncertainty about the ability to influence managers to act in their best interest does not seem to be the reason why shareholders do not diversify.

C Disaggregated effect of ownership on incentive contracts

In Table 5 we showed the effect of being a common owner on the choice of incentive contracts using a single variable to measure how strongly the contract incentivizes producing a high quantity. In this section we provide aggregated results from three regressions, in which we regress a dummy that is 1 if the shareholder chose relative profit incentives, a dummy that is one if the shareholder choose fixed incentives and a dummy that is 1 if the manager chose relative margin incentives respectively on a dummy that is one if the shareholder was a common owner.

Table 15: Relative Profit Incentives and ownership structure - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.3924***	0.3762***	0.5055***
	(SD=0.0241)	(SD=0.0535)	(SD=0.0617)
	(p<0.001)	(p<0.001)	(p<0.001)
CommonOwnership	-0.0428	-0.0420	-0.0557*
	(SD=0.0283)	(SD=0.0290)	(SD=0.0296)
	(p=0.130)	(p=0.148)	(p=0.060)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0016	0.0140	0.0179
N	3690	3690	3690

The table shows the result of a regression of a dummy that is one if a shareholder set relative profit incentives and 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. Standard errors are clustered on the subject level

Table 16: Fixed Incentives and ownership structure - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.2413***	0.2524***	0.1606***
	(SD=0.0227)	(SD=0.0541)	(SD=0.0560)
	(p<0.001)	(p<0.001)	(p=0.004)
CommonOwnership	-0.0590**	-0.0458*	-0.0359
	(SD=0.0248)	(SD=0.0252)	(SD=0.0255)
	(p=0.018)	(p=0.069)	(p=0.159)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0049	0.0282	0.0324
N	3690	3690	3690

The table shows the result of a regression of a dummy that is one if a shareholder set fixed incentives and 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. Standard errors are clustered on the subject level

Table 17: Relative Margin Incentives and ownership structure - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.3663***	0.3715***	0.3340***
	(SD=0.0225)	(SD=0.0673)	(SD=0.0722)
	(p<0.001)	(p<0.001)	(p<0.001)
CommonOwnership	0.1018***	0.0878***	0.0916***
	(SD=0.0285)	(SD=0.0305)	(SD=0.0311)
	(p<0.001)	(p=0.004)	(p=0.003)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0099	0.0220	0.0200
N	3690	3690	3690

The table shows the result of a regression of a dummy that is one if a shareholder set relative margin incentives and 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. Standard errors are clustered on the subject level

D Gender Differences

In this section we study if there are gender differences, by adding a dummy that is 1 if the subject is male and 0 if the subject is female to our main regression specifications. We drop all subjects who did not report their gender or report other from the analysis, as we do not have sufficient data-points to study other genders than male or female separately.

Table 18: Exchange decisions across rounds - Treatment 1 & 2 by Gender

	(1)	(2)	(3)
Constant	0.3847***	0.3620***	0.5104***
	(SD=0.0312)	(SD=0.0570)	(SD=0.0643)
	(p<0.001)	(p<0.001)	(p<0.001)
$Voted\ Exchanged_{t-1}$	0.4648***	0.4647***	0.4649***
	(SD=0.0391)	(SD=0.0390)	(SD=0.0388)
	(p<0.001)	(p<0.001)	(p<0.001)
$Exchange\ Occurred_{t-1}$	-0.0806**	-0.1019***	-0.0993***
	(SD=0.0323)	(SD=0.0316)	(SD=0.0326)
	(p=0.013)	(p=0.001)	(p=0.002)
Male	0.0312	0.0265	0.0274
	(SD=0.0431)	(SD=0.0435)	(SD=0.0425)
	(p=0.469)	(p=0.542)	(p=0.520)
$Voted\ Exchanged_{t-1}XMale$	-0.0820	-0.0846	-0.0836
	(SD=0.0571)	(SD=0.0572)	(SD=0.0572)
	(p=0.151)	(p=0.139)	(p=0.144)
$Exchange\ Occurred_{t-1}XMale$	0.0681	0.0786*	0.0751
	(SD=0.0454)	(SD=0.0447)	(SD=0.0461)
	(p=0.134)	(p=0.079)	(p=0.103)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.1556	0.1602	0.1672
N	3749	3749	3749

The table shows the result of a regression of a dummy that is one if a shareholder voted to exchange shares in a given round, on a dummy that is one if a shareholder wanted to exchange shares in the previous round and a dummy that is one if an exchange of ownership occurred in the previous round. Standard errors are clustered on the subject level.

Table18 shows that there are no significant differences in the decision of male and female shareholders to exchange shares. Neither the male dummy nor any of the interaction terms are significant at the 5% level.

Table 19: Incentives and ownership structure - Treatment 2 & 3

	(1)	(2)	(3)
Constant	-0.0685	-0.0850	0.0663
	(SD=0.0605)	(SD=0.1088)	(SD=0.1265)
	(p=0.258)	(p=0.435)	(p=0.600)
CommonOwnership	-0.0575	-0.0419	-0.0609
	(SD=0.0740)	(SD=0.0770)	(SD=0.0785)
	(p=0.437)	(p=0.586)	(p=0.438)
Male	0.1669**	0.1671**	0.1631**
	(SD=0.0813)	(SD=0.0794)	(SD=0.0799)
	(p=0.040)	(p=0.035)	(p=0.041)
CommonOwnershipXMale	-0.1403	-0.1576	-0.1509
	(SD=0.1014)	(SD=0.0997)	(SD=0.1002)
	(p=0.167)	(p=0.114)	(p=0.132)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0087	0.0170	0.0163
N	3630	3630	3630

The table shows the result of a regression of a variable that is one if a shareholder set relative profit incentives, 0 if she set fixed incentives and -1 if she set relative margin incentives on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. Standard errors are clustered on the subject level

Looking at the incentivization choices, Table 19 suggests that male shareholders are more likely to ex ante incentivize high production. With the male dummy and the interaction term the impact of common ownership on incentives is no longer significant and while the coefficients of the interaction term between the male dummy and the common ownership dummy are all negative and of a similar magnitude as the coefficient of the male dummy, they are not significant. Hence we cannot conclude that men are more likely to set anti-competitive incentives under common ownership then women are. In the ex post bonus treatment there are no difference between the behavior of male and female shareholders (Table 20).

Turning to the decisions of the managers, we fist examine if male managers are more likely to act in the best interest of their shareholders in the absence of evidence to do so. Table 23 weak evidence that this is the case. The interaction between the common Ownership dummy and the male dummy is positive in all regression specifications but it is insignificant without fixed effects and only marginally significant with fixed effects.

We also find some evidence that male managers respond stronger to incentives than

Table 20: Incentives and ownership structure - Treatment 1

	(1)	(2)	(3)
Constant	33.5637***	47.7254***	52.1820***
	(SD=3.9641)	(SD=7.8678)	(SD=7.9748)
	(p<0.001)	(p<0.001)	(p<0.001)
Common Ownership	-3.0386	-0.0004	-0.2132
	(SD=4.0631)	(SD=3.7936)	(SD=3.8846)
	(p=0.455)	(p=1.000)	(p=0.956)
Low Production	-8.0164	-12.6955**	-13.4436***
	(SD=5.3593)	(SD=5.2142)	(SD=5.2012)
	(p=0.135)	(p=0.015)	(p=0.010)
Low Production X Common Ownership	20.7413***	22.8688***	23.5271***
	(SD=7.6851)	(SD=6.8229)	(SD=6.9128)
	(p=0.007)	(p<0.001)	(p<0.001)
CommonOwnership X Male	1.6408	1.6152	1.6253
	(SD=5.9834)	(SD=5.5074)	(SD=5.5222)
	(p=0.784)	(p=0.769)	(p=0.769)
Low Production X Male	-0.1501	0.5832	0.5481
	(SD=6.4715)	(SD=5.7336)	(SD=5.7720)
	(p=0.981)	(p=0.919)	(p=0.924)
Low Production X Common Ownership X Male	-5.3371	-3.4579	-3.0115
	(SD=7.3623)	(SD=6.9297)	(SD=6.9143)
	(p=0.469)	(p=0.618)	(p=0.663)
Male	6.0883	6.1858	5.4943
	(SD=11.0144)	(SD=10.1976)	(SD=10.3262)
	(p=0.580)	(p=0.544)	(p=0.595)
Low Production + Low Production X Common Ownership	12.7249**	10.1733*	10.0835*
	(SD=5.8062)	(SD=5.4442)	(SD=5.4650)
	(p=0.028)	(p=0.062)	(p=0.065)
Low Production X Male + Low Production X Common Ownership X Male	0.7512	2.7279	2.4828
	(SD=8.8582)	(SD=8.5160)	(SD=8.6131)
	(p=0.932)	(p=0.749)	(p=0.773)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0364	0.1241	0.1232
N	1755	1755	1755

The table shows the result of a regression of the bonus paid by the shareholder to the manager on a dummy that is 1 if the shareholder was a common owner and 0 otherwise, a dummy that is 1 if the manager produced the low quantity and an interaction term. Standard errors are clustered on the subject level.

female managers. Table 22 shows a larger bonus payment leads to a stronger reduction in the probability to change the production decision in the next round if the manager is male. Interestingly, with ex ante incentives we find that male managers are overall more likely to produce the low quantity but the share with which the low quantity is produced drops stronger with relative profit incentives for men.

Table 21: Production and ownership structure

	(1)	(2)	(3)
Constant	0.2185***	0.2303***	0.4146***
	(SD=0.0652)	(SD=0.0808)	(SD=0.1418)
	(p<0.001)	(p=0.004)	(p=0.003)
CommonOwnership	0.0696	0.0352	0.0243
	(SD=0.0779)	(SD=0.0663)	(SD=0.0683)
	(p=0.371)	(p=0.596)	(p=0.721)
Male	0.0700	0.0172	0.0101
	(SD=0.0777)	(SD=0.0724)	(SD=0.0743)
	(p=0.367)	(p=0.813)	(p=0.892)
CommonOwnershipXMale	0.0678	0.1601*	0.1666*
	(SD=0.0988)	(SD=0.0915)	(SD=0.0918)
	(p=0.493)	(p=0.080)	(p=0.069)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0230	0.1177	0.1162
N	745	745	745

The table shows the result of a regression of a dummy that is 1 if the manager produced the low quantity ad 0 otherwise on a dummy that is 1 if the shareholder was a common owner and 0 otherwise. The regression only uses data from decisions where the manager had fixed incentives. Standard errors are clustered on the subject level.

Table 22: Production Decisions & Incentives - Treatment 1

	(1)	(2)	(3)
Constant	0.3137***	0.4323***	0.4805***
	(SD=0.0326)	(SD=0.0694)	(SD=0.0859)
	(p<0.001)	(p<0.001)	(p<0.001)
Bonus Last Round	-0.0001	0.0002	0.0002
	(SD=0.0006)	(SD=0.0007)	(SD=0.0007)
	(p=0.823)	(p=0.821)	(p=0.810)
Male	0.0842	0.1152**	0.1141**
	(SD=0.0567)	(SD=0.0538)	(SD=0.0538)
	(p=0.137)	(p=0.032)	(p=0.034)
Bonus Last RoundX Male	-0.0018*	-0.0028***	-0.0028***
	(SD=0.0011)	(SD=0.0011)	(SD=0.0011)
	(p=0.084)	(p=0.008)	(p=0.008)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0075	0.0248	0.0245
N	1638	1638	1638

The table shows the result of a regression of a dummy that is 1 if a manager changed the produced quantity in round t relative to round t-1 and 0 otherwise on the bonus paid to the manager in round t-1. Standard errors are clustered on the subject level.

Table 23: Production Decisions & Incentives - Treatment 2 & 3

	(1)	(2)	(3)
Constant	0.2561***	0.2167***	0.3460***
	(SD=0.0394)	(SD=0.0698)	(SD=0.0764)
	(p<0.001)	(p=0.002)	(p<0.001)
Relative Profit	0.0375	0.0474	0.0390
	(SD=0.0456)	(SD=0.0421)	(SD=0.0427)
	(p=0.411)	(p=0.261)	(p=0.361)
Relative Margin	0.2549***	0.2644***	0.2567***
	(SD=0.0509)	(SD=0.0477)	(SD=0.0480)
	(p<0.001)	(p<0.001)	(p<0.001)
Male	0.1036**	0.1086**	0.1078**
	(SD=0.0527)	(SD=0.0499)	(SD=0.0500)
	(p=0.049)	(p=0.029)	(p=0.031)
Relative ProfitXMale	-0.1270**	-0.1295**	-0.1307**
	(SD=0.0606)	(SD=0.0578)	(SD=0.0580)
	(p=0.036)	(p=0.025)	(p=0.024)
Relative MarginXMale	-0.0505	-0.0583	-0.0552
	(SD=0.0683)	(SD=0.0665)	(SD=0.0667)
	(p=0.460)	(p=0.381)	(p=0.408)
Session Fixed Effects	no	yes	yes
Round Fixed Effects	no	no	yes
Adjusted R^2	0.0652	0.0951	0.0986
N	3630	3630	3630

The table shows the result of a regression of a dummy that is 1 if a manager produced the low quantity and 0 otherwise on a dummy that is 1 if the manager was paid with relative profit incentives ad 0 otherwise and a dummy that is 1 if the manager was paid with relative margin incentives and 0 otherwise. The baseline in this regression is a manager with fixed incentives. Standard errors are clustered on the subject level.