“Treating customers like markets: Tacit collusion and mutual forbearance in B2B oligopolies”

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TREATING CUSTOMERS LIKE MARKETS: TACIT COLLUSION AND MUTUAL FORBEARANCE IN B2B OLIGOPOLIES

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Abstract

In business-to-business contract markets, oligopolistic suppliers often exhibit stable pricing patterns and low customer switching rates that cannot be explained by explicit coordination. This paper investigates how market characteristics enable tacit collusion through customer-specific mutual forbearance, where competitors implicitly treat individual customers as separate market spheres, each served through individualized contracts.

We use a controlled laboratory experiment based on a dynamic Bertrand oligopoly with three suppliers and ten distinct customers across 17 trading periods. The design systematically varies two conditions: whether suppliers receive ex-post information on competitors' transaction prices and customer relationships, and whether they can set individualized prices per customer. Customer decisions are simulated algorithmically to focus on supplier strategies and reduce variance. The experiment thus isolates the combined effect of price differentiation and information transparency on pricing under switching costs.

Our results demonstrate that when ex-post information and price differentiation coincide, suppliers develop implicit "customer ownership" understandings without explicit communication. We show that this combination significantly reduces customer-supplier switching and leads to higher offer and transaction prices compared to markets where either factor is absent. Additionally, suppliers engage in less aggressive poaching behavior when both information transparency and pricing flexibility are present.

These results confirm that information transparency enables suppliers to monitor customer boundaries and credibly threaten retaliation, while customer-specific pricing provides the mechanism for targeted punishment of boundary violations. Further, the findings provide managers in B2B sectors with actionable tools for strategic coordination.

Keywords industrial organization, tacit collusion, mutual forbearance, B2B contract markets, oligopoly, customer-specific pricing, market information

JEL Classification L11, L13, D43, C70

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INTRODUCTION

Oligopolistic suppliers in business-to-business contract markets frequently exhibit stable pricing patterns and remarkably low customer turnover despite the absence of explicit agreements (Anderson & Narus, 2004). This phenomenon – often labeled mutual forbearance (Bernheim & Whinston, 1990; Feinberg, 1984; Phillips & Mason, 1992) – emerges when firms implicitly recognize individual customers as virtually exclusive market spheres (Boeker et al., 1997; Bernheim & Whinston, 1990; Karnani & Wernerfelt, 1985) and refrain from aggressive undercutting to avoid retaliatory losses. Notable evidence appears in the chemical industry, where dominant producers negotiate individualized contracts for commoditized products while maintaining persistent margins (Gilbert & Lieberman, 1987).

Such markets exhibit fundamental characteristics that enable tacit coordination: oligopolistic structure with few suppliers holding considerable market shares; limited distinct customers purchasing the majority of volume; customer-specific price negotiation through individual contracts (Anderson & Narus, 2004); switching costs enabling the emergence of quasi-independent submarkets at the customer level (Chen, 1997; Fudenberg & Tirole, 2000; Pazgal & Soberman, 2008; Schmalensee & Willig, 1989; Carlton & Perloff, 2015); and suppliers' ability to monitor rival transaction relationships and prices. Together, these features foster an environment where implicit "customer ownership" norms develop, as suppliers calculate that long-term losses from retaliatory responses outweigh short-term gains from poaching rivals' clients. Our interest lies in exploring which of these characteristics facilitates cooperative behavioral patterns that reduce competitive intensity.

To systematically interpret these market patterns, this study integrates core concepts from industrial organization and B2B marketing, focusing on how fundamental market structures foster or inhibit tacit coordination among suppliers. Building on both industrial organization theory and B2B marketing research, this study conceptualizes contract markets as systems of individualized customer segments within complex oligopolistic structures (Schmalensee & Willig, 1989; Carlton & Perloff, 2015; Anderson & Narus, 2004).

These analytical foundations are complemented by empirical and theoretical work on the specific market factors that shape oligopolistic competition, including supplier numbers (Dolbear et al., 1968; Fouraker & Siegel, 1963), capacity structure (Brown-Kruse et al., 1994), cost structure (Stoecker, 1980), switching costs (Klemperer, 1995; Fourberg, 2023; Umezawa & Yamakawa, 2025), information effects (Dolbear et al., 1968; Fouraker & Siegel, 1963), and price differentiation (Fudenberg & Villas-Boas, 2006).

Looking at the five fundamental market characteristics described above and considering that the number of suppliers and customers, as well as switching costs, are usually given in a market, we primarily focused on the effect of information and price differentiation.

1. LITERATURE REVIEW

Theoretical studies on information effects have produced inconclusive results. Stigler (1964) argued that information facilitates collusion by enabling detection and punishment of secret price-cutting, while Vega-Redondo (1997) contended that information intensifies competition by providing incentives to imitate superior performers. Experimental evidence shows no agreement (Feinberg & Snyder, 2002; Fouraker & Siegel, 1963; Huck et al., 2000). Bertrand market experiments suggest either no impact of ex-post information on market outcomes (Huck et al., 2000) or facilitation of rival monitoring, thereby reducing competitive intensity (Feinberg & Snyder, 2002).

Regarding price differentiation, our paper focuses on behavior-based price discrimination – pricing based on customers' past purchase behavior rather than observable exogenous characteristics (Fudenberg & Villas-Boas, 2006). While monopolists benefit from price discrimination (Corts, 1998), oligopolistic effects are less clear. Traditional third-degree price discrimination studies suggest firms may be worse off than with uniform pricing (Thisse & Vives, 1988). Studies on behavior-based price discrimination largely confirm this view (Chen, 1997; Pazgal & Soberman, 2008), though Horstmann and Kraemer (2013) found that price discrimination can lead to more tacit collusion.

Prior industrial organization research has modeled how price discrimination – particularly at the customer level – can amplify or dampen competition depending on market segmentation and information structures (Fudenberg & Villas-Boas, 2006; Chen, 1997; Pazgal & Soberman, 2008). While most theoretical contributions have focused on aggregate outcomes, this paper extends the analysis to customer-specific coordination, connecting behavior-based discrimination with mechanisms for tacit collusion and mutual forbearance (Horstmann & Kraemer, 2013; Schmalensee & Willig, 1989).

Recent theoretical advances show that the impact of behavior-based price discrimination depends critically on horizontal and vertical differentiation and switching costs (Umezawa, 2022; Umezawa & Yamakawa, 2025). Empirical literature underscores that discriminatory pricing adoption is constrained by customer antagonism and fairness heuristics, while repeated interactions reinforce price tailoring to individual purchase histories (Leibbrandt, 2020; Brokešová et al., 2014).

When interpreting individual customers under price differentiation as separate markets, suppliers gain multimarket contact and therefore presence across multiple customer-markets with extended interdependence (Areeda & Turner, 1979).

Edwards (1955) argued that multimarket contact creates incentives to reduce competitive intensity because suppliers account for mutual retaliatory power across all markets, adopting less aggressive strategies. This mutual forbearance hypothesis has been elaborated by Bernheim and Whinston (1990), who identified conditions determining when multimarket contact leads to collusion: non-identical firms, markets, or economies of scale violations enable collusion through multimarket contact. Empirical research confirms this logic: Dekeyser et al. (2021) document that intensive multimarket contact among audit firms correlates with higher prices and lower rivalry. Importantly, mutual forbearance has also been observed under controlled laboratory conditions, further validating the robustness of this phenomenon (Feinberg & Sherman, 1988).

In summary, prior research provides mixed evidence on how information and price differentiation shape pricing behavior. The literature suggests that behavior-based price discrimination and multimarket contact can either intensify or soften rivalry, depending on specific market conditions and information structures. Building on these insights, the present study explores how customer-level price discrimination and information interact with mechanisms of tacit collusion and mutual forbearance in an oligopolistic setting.

1.1. Research objective and hypotheses

Despite extensive separate literatures on information effects and price discrimination, their combined effects have not been analyzed using our specific focus. In addition, field studies alone do not provide conclusive results.

By illuminating how modern market intelligence tools can paradoxically dampen competitive intensity (Nawaz & Wagner, 2025; Bakos, 1998), this study offers actionable insights for managers seeking strategic levers in B2B contract markets. We extend existing literature by deriving specific insights on how fundamental market characteristics facilitate mutual forbearance and bridge the literature on behavior-based price discrimination and multimarket contact (Bernheim & Whinston, 1990; Karnani & Wernerfelt, 1985; Fudenberg & Villas-Boas, 2006; Chen, 1997).

Our study focuses on the question of whether information and price differentiation in combination give rise to mutual forbearance behavior in such a setting, or if the presence of one or the other separately is sufficient. Furthermore, we aim to understand whether potentially successful mutual forbearance behavior ultimately leads to superior prices.

To answer this research question, we employ a controlled laboratory experiment in a dynamic Bertrand oligopoly in the presence of switching costs. Over 17 periods, participants faced three treatment conditions. The three treatments under consideration differed with respect to the ability of suppliers to price discriminate as well as the ex-post information available to suppliers.

As previous papers show (Brown-Kruse et al., 1994), the first periods of an experiment are often marked by significant price or margin declines, respectively. In this phase, other rules apply than once markets have settled. Our hypotheses, formulated below, therefore primarily refer to the second half of the game, when prices are already low, and margins are small. To avoid circular reasoning, the appropriate cut-off point was defined by periods rather than certain price/margin thresholds. In more detail, we distinguished between the

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first and second halves of the game (periods 1–8 and 9–16). Note that the last period (period 17) was excluded from our analysis to avoid the potential bias of endgame effects.

We hypothesize that mutual forbearance can only develop in settled markets where, in addition to switching costs, ex-post information on transaction prices and relationships, as well as price differentiation, are present. If these market conditions coincide, suppliers can tacitly (therefore not *per se* illegally) coordinate with their rivals, fully benefit from the ex-post information available, and set prices in a more cooperative way.

1.2. Mutual forbearance hypotheses

Edwards (1955) pointed out that under multimarket contact, suppliers have an "[…] incentive to live and let live, to cultivate a cooperative spirit, and to recognize priorities of interest in the hope of reciprocal recognition" (p. 335). Therefore, we chose to look at customer switching behavior as a measure of mutual forbearance behavior.

Whenever suppliers have established and probably marked specific market spheres – in contract markets, this can be specific, single customers – they can establish an implicit ownership understanding of customers in these spheres. Boeker et al. (1997) used the word "territory" to describe a type of market sphere that is especially geographically oriented. In essence, we believe that whenever suppliers have established implicit customer ownership understandings based on diverse customer characteristics – which may be geographical, but can equally be historical, industrial, relationship-based, or follow any other distinguishing logic without requiring systematic patterns – they are reluctant to attack each other's customer base to avoid potential retaliation. This is closely related to empirical findings and theory on territorial competition and multimarket contact (Karnani & Wernerfelt, 1985). These customer-specific market spheres can emerge organically based on virtually any customer attribute or relationship history, making each customer relationship a quasi-separate submarket regardless of the underlying segmentation logic (Chen, 1997; Fudenberg & Tirole, 2000; Pazgal & Soberman, 2008; Horstmann & Kraemer, 2013).

Hence, and consequently, the number of customer-supplier switches should decline as the probability that a supplier will attack the customer base of a rival also declines. We distinguish between "all" supplier switches (in the sense of "any switch") (hypothesis 1) and the so-called "enduring" supplier switches (hypothesis 2) of the customer. The latter operationalization considers that a customer might be lost in one period but re-gained in the following period, for example, due to a supplier reaction (such a situation would not be considered an enduring switch and would be omitted from the analysis). In cases of territorial development, suppliers should try to immediately gain back any lost customers. Therefore, "enduring" switches (as well as "all" switches) should be more probable if either price differentiation or ex-post information is missing (i.e., there is an absence of territories).

H1: The probability for any supplier switch is higher in settled markets (second half of the game) without price differentiation or ex-post price information than in markets with price differentiation and ex-post price information.

H2: The probability for an enduring supplier switch is higher in settled markets (second half of the game) without price differentiation or without ex-post price information than in markets with price differentiation and ex-post price information.

1.3. Competition intensity hypotheses

We focused on the price levels in the markets under consideration as a measure of competition intensity. Similar to Buchheit and Feltovich (2011), we distinguished between offer prices (all price offers subjects make) and transaction prices (prices that have materialized in the markets in the form of transactions between sellers and buyers). We also investigated the occurrence of a pricing practice called "poaching". Fudenberg and Tirole (2000) defined poaching as when suppliers offer their customers a special discount or other inducements to switch suppliers. Under price discrimination, suppliers have an incentive to attack their rivals' customer bases. Because all suppliers have similar strategic incentives, competition grows more intense than when uniform prices exist (Gehrig & Stenbacka, 2005). This corresponds to what Chen (1997) calls "[…] "paying customers to switch" […]" (p. 878). In this paper, we consider an extreme case of poaching: the setting of prices below marginal costs to win customers from competitors. This may (or may not) pay off later as customers attempt to avoid switching costs and stay with their previous suppliers (although prices may be higher). This operationalization accounts for the high competitive intensity that we expect in our markets, and relates to Chen (1997), who found that firms tend to set prices below marginal costs to poach customers away from their rivals. However, the model is restricted to treatments with price differentiation only, as poaching is not possible otherwise. Overall, we hypothesize that the intensity of competition (in terms of prices and poaching) is lowest when suppliers can price discriminate but have access to ex-post information.

H3: *Offer prices are lower in settled markets (second half of the game) without price differentiation or ex-post price information than in markets with price differentiation and ex-post price information.*

H4: *Transaction prices are lower in settled markets (second half of the game) without price differentiation or ex-post price information than in markets with price differentiation and ex-post price information.*

H5: *The probability for poaching is higher in settled markets (second half of the game) with price differentiation but without ex-post price information than in markets with price differentiation and ex-post price information.*

2. METHOD

We considered a dynamic posted-offer market (Bertrand game) over T = 17 periods with three symmetric (simulated) suppliers/firms, i ∈ {1, 2, 3}, which offer homogeneous products, and ten distinct customers who demand exactly one indivisible unit of that good in each period (i.e., price elasticity of demand is assumed zero for reasons of simplicity).

The number of suppliers in laboratory experiments on oligopolistic markets is usually between two and four competitors. We included three suppliers in our setting for two primary reasons.

Most (real) oligopolistic markets have more than two firms. For example, Hay and Kelley (1974) showed that many industries under scrutiny for collusion encompass more than two players.

In markets with two suppliers/firms, there is, *per se*, a high degree of collusion. For example, Huck et al. (2004) noted that successful collusion in markets with three firms seldom occurs; in particular, the transition from two to three firms shows a significant impact on the intensity of competition.

In addition, there were no capacity constraints on the supply side in our market setting, and cost structures were symmetric. The supply of one unit of the product always implies a marginal cost of c = 70 currency units (CU) to each supplier; there are no fixed costs.

Furthermore, we decided to model a limited number of specific, single customers so that our markets were similar to real business-to-business markets, where the number of relevant customers for specific commoditized products is also limited. This helps suppliers easily segment the market for price differentiation treatments. We chose ten customers, as this number clearly exceeds the number of suppliers, but is still limited in the sense that suppliers do not have to set too many different price points if they pursue the strategy of price individualization. Furthermore, the customers were myopic; that is, they decided for the lowest cost per unit in the period at hand, combining price and possible switching costs in their considerations, thus not demonstrating strategic behavior. Consequently, we were able to model customer behavior algorithmically (without actual involvement of experiment participants). This method has been criticized in the literature (Brown-Kruse, 1991) but is still a widely used approach if buyer behavior is not in the center of attention (Buchheit & Feltovich, 2011; Durham et al., 2004; Fonseca & Normann, 2008; Orzen & Sefton, 2008).

Our markets open in situations where "[…] consumers' switching costs have already been built up", sometimes also called "mature markets" (Klemperer, 1995, p. 519). In period 1, each sup-

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plier already has a certain number of customers who have previously purchased from the supplier (suppliers 1 and 2 have three each, and supplier 3 has four).

Overall, we believe that our market setting is more competitive than collusive (three suppliers, a number of customers that cannot be equally split between the three suppliers, unlimited capacity, and so on).

At the beginning of each period, suppliers determine the prices for one unit of the homogeneous good; thereby, depending on the respective treatment condition, the supplier can set only one price or up to ten different price points, one for each customer (the latter in Treatments 2 and 3 with price differentiation; Table 1). Afterwards, the customers decide from which supplier they buy. In general, they always purchase from the cheapest supplier, but they also consider constant switching costs (4.5 CU) when they change suppliers from one period to the next. Switching costs are especially relevant when suppliers can discriminate prices, as these costs are prerequisites for price differentiation to produce interesting strategic options. They allow suppliers to separate their customers into two different groups: their own customers and competitors' customers (Chen, 1997).

Similarly, to price discrimination, the ex-post information available to suppliers varies by treatment (Table 1). The main difference is that in Treatments 1 and 3, suppliers learn which customers purchase from which suppliers (transaction relationships), at which (transaction) price. Pure offer prices (without transaction materialization) are never transparent for suppliers to avoid noise through signaling that may otherwise be pricelessly possible.

In summary, we distinguished between the following three treatments (Table 1):

- Treatment 1: No price differentiation, but ex-post information on prices as well as supplier-buyer relationships.
- Treatment 2: Price differentiation, but no ex-post information on prices and supplier-buyer relationships.
- Treatment 3: Price differentiation and ex-post information on prices and supplier-buyer relationships.

Being primarily interested in whether information and price differentiation in combination give rise to mutual forbearance behavior, we set Treatment 3 as the reference treatment of this experiment. As

Table 1. Overview of treatments

Attributes		Reference treatment		
		Treatment 1	**Treatment 2**	**Treatment 3**
		No price differentiation, but ex-post information on prices, as well as supplier-buyer relationships	**Price differentiation, but no ex-post price information**	**Price differentiation and ex-post information on prices, as well as supplier-buyer relationships**
Price differentiation		No	Yes	Yes
Switching costs		Yes	Yes	Yes
Product		**Homogeneous**		
Ex-ante information	# of Sellers	Yes		
	# of Periods	No		
	Demand (starting point, elasticity, growth)	Yes		
	Cost (own/rival)	Yes / Yes		
	Switching cost (quantitatively)	Yes		
Ex-post information	Offer prices (own/rival)	Yes / No	Yes / No	Yes / No
	Transaction prices (own/rival)	Yes / Yes	Yes / No	Yes / Yes
	Quantities (own/rival/total)	Yes / Yes / Yes	Yes / No / Yes	Yes / Yes / Yes
	Transaction relationships (own/rival)	Yes / Yes	Yes / No	Yes / Yes
	Profit (own/rival)	Yes / No	Yes / No	Yes / No

our hypotheses focus on the effect of eliminating either price differentiation (Treatment 1) or information (Treatment 2) from this reference treatment, we did not construct a fourth treatment eliminating both factors (information and price differentiation), thereby producing what is essentially a standard Bertrand market with switching costs.

The experiment was programmed in z-Tree (Fischbacher, 2007) and conducted at the Karlsruhe Institute of Technology (KIT), Germany. We simulated 59 markets (16 in Treatment 1, 14 in Treatment 2, 29 in Treatment 3) with 177 participants, primarily KIT students recruited via ORSEE (Greiner, 2004). Subjects were randomly assigned to treatments, with sessions (≤ 90 min) conducted under identical and non-communicating conditions.

The experimental procedures were conducted based on the COPE Guidelines on good publication practice (COPE, 1999). Participation in the experiment was entirely voluntary, and all participants provided written informed consent prior to participation in the study. Earnings accumulated over 17 periods were converted into Euros at a fixed rate and paid immediately after the session, including a 5 EUR show-up fee. Average earnings were 9.33 EUR, with a maximum of 30 EUR reached once in Treatments 1 and 2. Collected data were anonymized, securely stored, and used exclusively for research purposes in pseudonymized form. A formalized ethics approval was thus not required for this study due to the non-invasive, anonymous, and low-risk nature of the experiment, as per the institutional and national guidelines applicable. All research procedures and decisions were conducted impartially, with neutrality and fairness, avoiding any bias or undue influence, to ensure objective and valid scientific results. Data are available from the authors upon reasonable request, subject to data protection regulations.

3. RESULTS

Before discussing the results of our regression analyses, we report some selective descriptive statistics of our markets. As an indicator for the degree of mutual forbearance behavior we look at one operationalization of supplier switching

Table 2. Descriptive statistics – (all) Supplier switches (in % of transactions)

Treatment	Periods																Total	Half 1	Half 2
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
1	40	40	42	13	31	33	31	27	14	31	4	18	28	8	17	25	25.0	31.9	18.0
																	(49.4)	(46.6)	(38.4)
2	50	40	37	34	32	30	24	21	18	15	23	25	19	17	21	18	26.6	33.5	19.2
																	(44.2)	(47.2)	(39.4)
3	39	50	35	29	27	32	27	21	11	18	16	19	12	11	24	17	24.2	32.5	15.9
																	(42.8)	(46.8)	(36.5)

Note: Half 1: Periods 1–8; Half 2: Periods 9–16; Period 17: Omitted due to potential end game effects; Std.-dev. in brackets.

Table 3. Descriptive statistics – Offer prices (in currency units)

Treatment		Total			Half 1			Half 2		
		1	2	3	1	2	3	1	2	3
Price	Average	75.6	73.3	87.8	79.6	75.7	89.6	71.7	70.7	86.1
	Std.-dev.	17.8	10.1	105.1	23.8	12.7	103.9	5.7	5.0	106.2
	25%-perc.	70.0	69.0	70.0	70.0	70.0	70.0	69.0	69.0	70.0
	Median	71.0	71.0	71.0	73.0	73.0	73.0	70.0	70.0	71.0
	75%-perc.	74.0	74.0	75.0	80.0	80.0	79.0	72.0	72.0	72.0
Highest Price	Average	90.1	102.3	159.1	97.8	91.9	165.9	82.4	112.7	152.2
	Std.-dev.	35.9	108.9	239.7	43.5	33.8	243.6	23.7	149.6	235.5
Lowest Price	Average	70.9	66.1	68.0	73.3	66.0	68.7	68.5	66.1	67.3
	Std.-dev.	6.9	8.4	5.2	9.0	10.0	6.9	1.8	6.4	2.2

Note: Half 1: Periods 1–8; Half 2: Periods 9–16; Period 17: Omitted due to potential end game effects.

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behavior, namely "all" switches (Table 2; descriptive statistics on "enduring" switches are available upon request). With respect to the intensity of competition we look at average offer and transaction prices as well as "poaching" (Tables 3, 4, and 5).

Looking at supplier switching as an indicator for mutual forbearance behavior (Table 2), we observe that supplier switching declines in the second half of the game compared to the first in all three treatments. In the second half, average switching is lowest in Treatment 3. For the first half, this result does not hold (Treatment 1 is lowest); however, because switching is lowest when suppliers are able to discriminate prices and have ex-post information in the second half of the game, our hypotheses of mutual forbearance behavior (hypothesis 1) receives preliminary support. This observation is also confirmed by a Satterthwaite-Welch-Test at the 1%-level (Satterthwaite, 1946; Welch, 1951) or a non-parametric Mann-Whitney U test at the 1% level (detailed *t*- and *z*-statistics and *p*-values for these tests are available upon request) (Mann & Whitney, 1947; Wilcoxon, 1945).

We also observe that offer prices (Table 3) decrease with the number of periods in all treatments, which is consistent with our expectations outlined in the hypothesis section. Offer prices are quickly below the starting price of 100 CU. A first glimpse at the treatment differences suggests that price differentiation in combination with ex-post information (Treatment 3) always leads to a higher offer price as compared to a situation wherein suppliers cannot price discriminate (Treatment [T.] 1 vs. 3), or when they lack ex-post information (T. 2 vs. T. 3). This is preliminary support for hypothesis 3. The observation for the second half is also confirmed by a Satterthwaite-Welch-Test or also a non-parametric Mann-Whitney U test, both at 1% level.

In transaction prices (i.e., prices that have materialized in the market), we also see a decrease with the number of periods across all treatments (Table 4) and prices that are quickly below the starting price of 100 CU. Therefore, the markets indeed appear more competitive than collusive, which is in line with our expectations of a market with three suppliers. We also get a first indication that price differentiation in combination with ex-post information leads to higher transaction prices (hypothesis 4). Here, this is the case in later periods when prices approach marginal costs and margins are low. In the first half of the game, when suppliers have the same level of ex-post information about prices, price differentiation seems to reduce transac-

Table 4. Descriptive statistics – Transaction prices (in currency units)

Treatment		Total			Half 1			Half 2		
		1	2	3	1	2	3	1	2	3
Price	Average	71.6	70.4	71.1	73.0	70.9	71.7	70.3	69.9	70.5
	Std.-dev.	5.1	6.4	5.1	6.6	8.0	6.7	2.3	3.9	2.5
	25%-perc.	69.0	68.0	69.0	70.0	68.0	69.0	69.0	68.0	70.0
	Median	71.0	71.0	71.0	72.0	72.0	71.0	71.0	71.0	71.0
	75%-perc.	73.0	73.0	73.0	74.0	74.0	74.0	72.0	72.0	72.0
Highest Price	Average	73.4	73.4	73.1	76.1	74.8	74.2	70.7	71.9	72.0
	Std.-dev.	7.9	6.0	5.5	10.3	7.8	7.4	2.2	2.6	2.1
Lowest Price	Average	72.1	66.6	68.6	74.1	66.5	68.9	70.1	66.7	68.2
	Std.-dev.	6.9	8.6	5.4	9.0	10.2	7.0	2.4	6.7	2.9

Note: Half 1: Periods 1–8; Half 2: Periods 9–16; Period 17: Omitted due to potential end game effects.

Table 5. Descriptive statistics – "Poaching" (in % of transactions)

Treatment	Periods																Total	Half 1	Half 2
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
2	1	5	14	13	24	25	29	26	27	31	41	30	29	29	31	31	23.9	17,1	31.2
																	(42.7)	(37.7)	(46,3)
3	1	9	11	17	17	20	20	15	16	21	22	21	18	19	26	24	17.4	13.6	21.1
																	(37.9)	(34.3)	(40.7)

Note: Half 1: Periods 1–8; Half 2: Periods 9–16; Period 17: Omitted due to potential end game effects; Std.-dev. in brackets.

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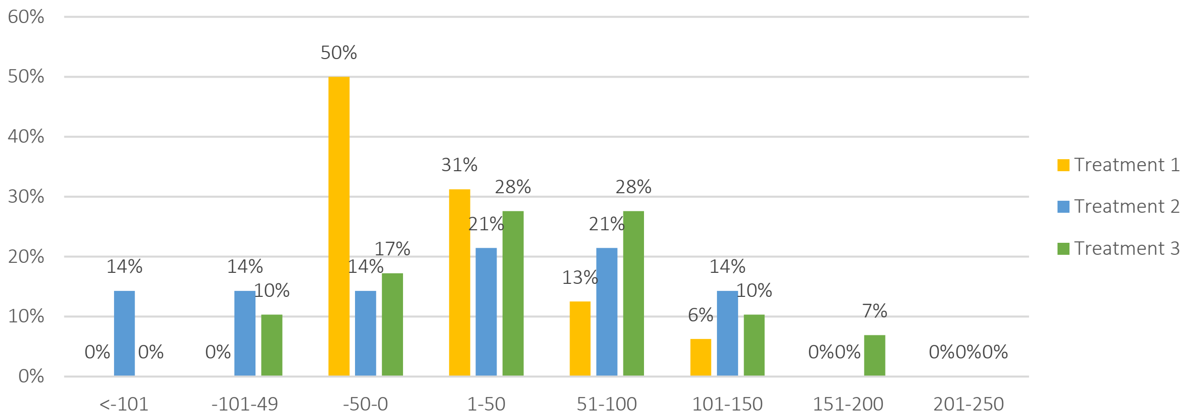

Figure 1. Descriptive statistics – Distribution of profits in game half 2 by treatment (in % of markets)

tion prices on average (T. 1 vs. 3). A lack of ex-post price information at this early point in the game appears to create lower transaction prices (T. 2 vs. T. 3). This supports the suggestion that price differentiation may decrease prices in settings where margins are high (first half of the game) and increase prices when margins deteriorate (second half of the game). The observation of higher transaction prices in Treatment 3 in game half 2 is also confirmed by a Satterthwaite-Welch-Test at the 1% level or a non-parametric Mann-Whitney U test at the 1% level.

This preliminary evidence of treatment differences in game half 2 is also in line with observations on the profit distribution for the same phase of the game: Figure 1 suggests that in 72% of markets under Treatment 3, positive (market) profits can be generated while this only holds for 50% or 57% of markets under Treatment 2 or 3, respectively.

Finally looking at "poaching" as an additional measure of the competitive intensity (Table 5), we observe that "poaching" is lowest when suppliers can discriminate prices and have ex-post information in the second half of the game (21.1%) compared to markets where such information is missing (31.2%). Hence, our (final) hypothesis 5 receives preliminary support, too. This observation is also confirmed by a Satterthwaite-Welch-Test at the 1%-level or a non-parametric Mann-Whitney U test at the 1% level.

To formally test hypotheses 1–5, we constructed five regression models using linear and logit regression analyses (the latter in case of a binary independent variable as found in models 1 ["All Switches"], 2 ["Enduring Switches"], and 5 ["Poaching"]). In more detail, we relied on panel regression models. Our data are structured on supplier/firm (models 1, 3, 5) or customer level (models 2 and 4). Thus, an observation is uniquely identified either by "subject × customer × period" or by "customer × period". Consequently, there are up to 13.920 observations per treatment (29 markets × 3 suppliers/firms × 10 customers × 16 periods).

To choose between a random (REM) or fixed effects (FEM) panel model, econometrics textbooks (Wooldridge, 2014) typically suggest to rely on general (technical) considerations (e.g., "[…] do time invariant explanatory variables have to be included in the model, thereby rendering the use of a FEM impossible as such variables are eliminated in the fixed effects transformation?"), or on assumptions regarding the correlation of the unobserved effects with the explanatory variables (e.g., "[…] is correlation between the two expected?"). Another quantitative approach to choosing between the two models is the Hausman test (Hausman, 1978). This test requires that both statistical models are estimated; however, because we use time invariant (treatment) variables, which are eliminated in the FEM estimation, we could only test with a reduced FEM that included only the time variant variables. The Hausman test results of these reduced models were inconclusive. To still ensure sufficient robustness of our results, we decided to estimate a REM and FEM. However, as time-invariant treatment variables still can-

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not be included in the standard FEM, we calculated the latter via a pooled OLS/Logit model with subject dummies for each participant (except one). The coefficients of the dummies were then ceteris paribus compared by treatment via a non-parametric Mann-Whitney U test. We also report the two-sided test results.

To control for collinearity in our models, we calculated the variance inflation factors (VIFs) for each variable. We did not observe a maximum VIF ≥ 10 – which is a widely recognized threshold level (Schendera, 2008) – in any of our models (Table 6).

To provide a solid understanding of our models, we should also mention that we used time invariant dummy treatment variables in our regressions (dTreatment1 and dTreatment2). Because Treatment 3 served as a reference treatment, it did not receive a dummy in the overall model. As outlined in the hypothesis subsection, we analyzed the two halves of the game (periods 1–8 and 9–16) separately by interacting our treatment variables with a dummy for each game half (e.g., dTreatment1×Gh1). In that case, we used the second half of Treatment 3 as a reference point and included a dummy for the first half of Treatment 3 (dTreatment3xGh1).

Table 6. Regression analysis – Random-effects models

Stata Results	Model 1 Random Effects (gllamm)		Model 1 Random Effects (gllamm)		Model 2 Random Effects (gllamm)		Model 2 Random Effects (gllamm)	
Dependent variable	**dAllSwitches**		**dAllSwitches**		**dEndSwitches**		**dEndSwitches**	
Independent variables	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**
dTreatment1	0.031	0.760	–	–	0.130	2.610***	–	–
dTreatment2	0.138	3.210***	–	–	0.114	2.210**	–	–
dTreatment1xGh1	–	–	1.020	9.210***	–	–	1.000	7.120***
dTreatment1xGh2	–	–	0.158	2.710***	–	–	0.262	3.720***
dTreatment2xGh1	–	–	1.137	10.310***	–	–	1.044	8.020***
dTreatment2xGh2	–	–	0.253	3.830***	–	–	0.190	2.330**
dTreatment3xGh1	–	–	1.075	10.510***	–	–	1.003	7.710***
Profit_t–1	0.059	16.490***	0.059	16.510***	–	–	–	–
Demand_t–1	–	–	–	–	–	–	–	–
dPeriod2	0.542	7.590***	0.543	7.600***	–	–	–	–
dPeriod3	0.329	4.120***	0.330	4.130***	–	–	–	–
dPeriod4	–0.161	–1.900*	–0.161	–1.890*	–0.136	–0.950	–0.136	–0.950
dPeriod5	0.038	0.470	0.039	0.490	–0.902	–7.330***	–0.901	–7.340***
dPeriod6	0.176	2.130**	0.177	2.150**	–0.695	–5.910***	–0.695	–5.900***
dPeriod7	–0.058	–0.710	–0.057	–0.690	–0.410	–3.570***	–0.409	–3.570***
dPeriod8	–0.304	–3.540***	–0.302	–3.530***	–0.703	–5.710***	–0.702	–5.710***
dPeriod9	–0.970	–9.890***	–	–	–0.894	–7.290***	–	–
dPeriod10	–0.445	–4.840***	0.527	5.470***	–1.612	–11.890***	–0.719	–5.000***
dPeriod11	–0.895	–9.500***	0.077	0.790	–1.007	–8.330***	–0.113	–0.910
dPeriod12	–0.506	–5.640***	0.466	5.120***	–1.647	–11.980***	–0.754	–5.280***
dPeriod13	–0.621	–6.730***	0.351	3.550***	–1.119	–9.240***	–0.225	–1.680*
dPeriod14	–1.147	–11.610***	–0.175	–1.730*	–1.228	–9.600***	–0.335	–2.640***
dPeriod15	–0.404	–4.780***	0.568	6.200***	–1.810	–12.710***	–0.917	–6.250***
dPeriod16	–0.512	–5.730***	0.459	5.040***	–1.228	–10.040***	–0.335	–2.600***
Constant	–1.000	–14.990***	–2.035	–26.250***	0.040	0.460	–0.910	–9.430***
Number obs	28110		28110		8190		8190	
R-sq within	–		–		–		–	
R-sq between	–		–		–		–	
R-sq overall (McKelvey & Zavoina's R-sq for Logit models)	0.09		0.10		0.08		0.08	
max. VIF (Variable)	2.17 (dPeriod7)		7.52 (dTreatment3xSph1)		1.86 (dPeriod4–dPeriod9)		5.35 (dTreatment3xSph1)	
Period dummies?	yes		yes		yes		yes	
Clustered Std. Errors?	yes		yes		yes		yes	

Note: * (**, ***) shows test statistics significantly different from zero at the 10% (5%, 1%) level.

Table 6. Regression analysis – Random-effects models (cont'd)

Stata Results	Model 3		Model 3		Model 4		Model 4		Model 5		Model 5		
	Random Effects		Random Effects		Random Effects		Random Effects		Random Effects		Random Effects		
Dependent variable	**Offer price**		**Offer price**		**Transaction price**		**Transaction price**		**dPoaching**		**dPoaching**		
Independent variables	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	**Coeff.**	**z-Statistics**	
dTreatment1	–12.218	–3.830***	–	–	0.488	2.660***	–	–	–	–	–	–	
dTreatment2	–14.561	–4.590***	–	–	–0.824	–3.310***	–	–	0.458	7.060***	–	–	
dTreatment1xGh1	–	–	8.446	1.530	–	–	10.072	22.310***	–	–	–	–	–
dTreatment1xGh2	–	–	–14.399	–4.250***	–	–	-0.276	–3.850***	–	–	–	–	–
dTreatment2xGh1	–	–	4.674	0.860	–	–	7.929	16.730***	–	–	–	–3.116	–9.020***
dTreatment2xGh2	–	–	–15.317	–4.520***	–	–	–0.731	–4.140***	–	–	–	0.565	6.650***
dTreatment3xGh1	–	–	18.480	5.030***	–	–	8.821	23.380***	–	–	–	–3.421	–10.110***
Profit_t-1	0.141	1.680*	0.136	1.620	–	–	–	–	–0.007	–1.340	–	–0.007	–1.350
Demand_t-1	–0.928	–1.710*	–0.911	1.680*	–	–	–	–	–	–	–	–	–
dPeriod2	–15.741	–7.010***	–15.777	–7.040***	–5.902	–18.420***	–5.902	–18.420***	2.341	6.830***	2.339	6.830***	
dPeriod3	–20.312	–8.810***	–20.359	–8.850***	–9.276	–24.450***	–9.276	–24.450***	2.862	8.640***	2.858	8.620***	
dPeriod4	–19.856	–8.980***	–19.909	–9.020***	–8.851	–26.220***	–8.851	–26.210***	3.228	9.500***	3.223	9.480***	
dPeriod5	–22.980	–9.640***	–23.031	–9.680***	–10.007	–27.550***	–10.007	–27.540***	3.514	10.410***	3.507	10.380***	
dPeriod6	–25.481	–9.820***	–25.535	–9.860***	–10.508	–24.800***	–10.508	–24.790***	3.667	10.860***	3.660	10.830***	
dPeriod7	–26.006	–9.960***	–26.060	–10.010***	–10.210	–28.360***	–10.210	–28.360***	3.731	11.190***	3.724	11.160***	
dPeriod8	–25.322	–9.710***	–25.376	–9.760***	–9.895	–26.890***	–9.895	–26.890***	3.451	10.190***	3.445	10.170***	
dPeriod9	–19.968	–6.330***			–9.197	–25.370***			3.525	10.470***			
dPeriod10	–25.288	–9.630***	–5.317	–3.160***	–9.740	–26.190***	–0.537	–3.710***	3.824	11.370***	0.303	3.540***	
dPeriod11	–25.129	–9.570***	–5.160	–3.070***	–9.381	–25.970***	–0.178	–1.420	4.057	12.200***	0.536	5.280***	
dPeriod12	–25.318	–9.650***	–5.349	–3.180***	–10.316	–26.220***	–1.112	–5.190***	3.813	11.280***	0.291	2.790***	
dPeriod13	–25.090	–9.530***	–5.122	–3.050***	–9.705	–27.120***	–0.502	–3.660***	3.653	10.790***	0.131	1.210	
dPeriod14	–23.257	–8.710***	–3.287	–1.930*	–9.038	–24.710***	0.165	1.300	3.714	11.040***	0.192	1.770*	
dPeriod15	–25.001	–9.540***	–5.031	–2.950***	–10.155	–27.760***	–0.952	–6.350***	4.039	12.080***	0.519	4.900***	
dPeriod16	–25.065	–9.480***	–5.097	–2.940***	–9.767	–26.470***	–0.564	–4.210***	3.940	11.680***	0.419	3.950***	
Constant	109.844	40.870***	90.641	23.120***	80.019	222.200***	71.007	671.530***	–5.291	–16.210***	–1.807	–21.310***	
Number obs	28110		28110		9370		9370		20430		20430		
R-sq within	0.04		0.04		0.25		0.26		–		–		
R-sq between	0.01		0.01		0.04		0.04		–		–		
R-sq overall (McKelvey & Zavoina's R-sq for Logit models)	0.02		0.02		0.22		0.23		0.20		0.20		
max. VIF (Variable)	2.18 (dPeriod7)		7.60 (dTreatment3xSph1)		1.87 (dPeriod2)		6.69 (dTreatment3xSph1)		2.16 (dPeriod7)		8.57 (dTreatment3xSph1)		
Period dummies?	yes		yes		yes		Yes		yes		yes		
Clustered Std. Errors?	yes		yes		yes		Yes		yes		yes		

Note: The regression models include dummy variables for each period as well as standard errors that were clustered on an adequate level (subject × customer level in models 1, 3, and 5 and on customer level in models 2 and 4) to control for fixed subject and time effects (Petersen, 2009); * (**, ***) shows regression coefficients significantly different from zero at the 10% (5%, 1%) level.

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Table 7. Regression analysis – Fixed effects models/results of the non-parametric Mann–Whitney U test

Variables	Model 1	Model 1	Model 3	Model 4	Model 5
	Fixed Effects (Logit)	Fixed Effects (Logit)	Fixed Effects (OLS)	Fixed Effects (OLS)	Fixed Effects (OLS)
Endogeneous V.	dAllSwitches	dEndSwitches	Offer price	Transaction price	dPoaching
Total					
Treatment 1 vs. Treatment 3	+	+ **	+	+ *	n/a
	0.638	2.180	0.812	1.895	
	(0.5233)	(0.0292)	(0.4168)	(0.0581)	
Treatment 2 vs. Treatment 3	+ ***	+ *	–***	–***	+ ***
	2.877	1.941	–7.494	–2.919	6.085
	(0.0040)	(0.0523)	(0.0000)	(0.0035)	(0.0000)
Half 1 (Period 1–8)					
Treatment 1 vs. Treatment 3	–	+	+	+ ***	n/a
	–1.109	0.932	1.337	2.826	
	(0.2673)	(0.3513)	(0.1812)	(0.0047)	
Treatment 2 vs. Treatment 3	+	+ *	–***	–	+ ***
	1.398	1.956	–4.912	–1.534	3.431
	(0.1622)	(0.0505)	(0.0000)	(0.1249)	(0.0006)
Half 2 (Period 9–16)					
Treatment 1 vs. Treatment 3	+ ***	+ ***	–***	–***	n/a
	3.138	3.098	–5.143	–3.696	
	(0.0017)	(0.0019)	(0.0000)	(0.0002)	
Treatment 2 vs. Treatment 3	+ **	+	–***	–***	+ ***
	1.996	0.722	–8.921	–3.357	5.468
	(0.0459)	(0.4704)	(0.0000)	(0.0008)	(0.0000)
Control variables in OLS model	Profit_t–1	–	Profit_t–1 Demand_t–1	–	Profit_t–1

Note: The numbers in the cells are the z-statistics of the non-parametric Mann-Whitney U test of the estimated (subject) dummy coefficients. The Prob > |z| is given between brackets. * (**, ***) shows test statistics significantly different from zero at the 10% (5%, 1%) level.

The results of our models 1–5 (one model per hypothesis) are summarized in Tables 6 and 7. Table 7 reports a summary of the two-sided non-parametric Mann–Whitney U tests conducted with the dummy variable coefficients.

The regression analysis of the impact of our treatment variables on mutual forbearance behavior suggests that when ex-post information is available, and suppliers can discriminate prices, subjects achieve some degree of tacit coordination regarding the allocation of customers as compared to situations where either is absent. This is best illustrated by looking at the number of customer-supplier switches – again, either all switches or only those that endure over several periods (models 1 and 2).

3.1. Hypothesis 1, Model 1

In line with our hypothesis, the probabilities for "all" switches in periods 9–16 are higher in Treatments 1 and 2 than in Treatment 3 (positive coefficient of the corresponding treatment variable). This is statistically significant in both models (in the REM at the 1% level [Table 6] and in the FEM at the 1% level [for Treatment 1] or 5% level [for Treatment 2], respectively [Table 7]). Looking at the entire game, we also find positive coefficients; however, the result is significant at the 1% level only for Treatment 2, but not significant for Treatment 1.

3.2. Hypothesis 2, Model 2

Hypothesis 2 is also fully confirmed in the REM (Table 6) for periods 9–16. The probability for enduring switches is statistically significantly higher at the 1% and 5% levels in Treatments 1 and 2 compared to Treatment 3 in the second half of the game. In the FEM (Table 7), our hypothesis is confirmed at the 1% level only for Treatment 1. Again, looking at the entire game, enduring switches are more probable in Treatments 1 and 2. This is statistically significant for all models (for the REM at the 1% level for Treatment 1 and at the 5% level for Treatment 2 [Table 6]; and for the FEM at the 5% level for Treatment 1 and the 10% level for Treatment 2, respectively [Table 7]). Overall, we find at least partial support for our hypothesis.

With regard to the intensity of competition, models 3–5 demonstrate that when markets have settled and suppliers can price discriminate and have access to ex-post information (as in Treatment 3), competitive intensity is lower than in situations where either is absent (offer and transaction prices are higher and the probability for poaching is lower).

3.3. Hypothesis 3, Model 3

In model 3, the coefficients of the variables for Treatments 1 and 2 are negative in the REM and FEM for periods 9–16. This is consistent with our hypothesis and statistically significant at the 1% level (Tables 6 and 7). Thus, offer prices are statistically significantly lower when either price differentiation or ex-post price information is absent. Put differently, offer prices are highest when both factors (price differentiation and ex-post information) coincide in a market where margins have already eroded. In the REM (Table 6), this result also holds for the entire game at the 1% level, whereas in the FEM it holds only for Treatment 2 (also at the 1% level [Table 7]).

3.4. Hypothesis 4, Model 4

First, looking at the second half of the game, we also find support for our fourth hypothesis. In both models, the coefficients of the treatment variables are statistically significantly negative at the 1% level. Thus, transaction prices are lower in both Treatments 1 and 2 than in Treatment 3 (Tables 6 and 7). Again, once margins are low, transaction prices are highest when price differentiation and ex-post price information coincide. However, when looking at the entire game, the coefficients of the treatment variables point in opposite directions (Treatment 1 = positive, Treatment 2 = negative). In the REM (Table 6) and the FEM (Table 7), transaction prices appear to be higher when price differentiation is absent (Treatment 1) but lower when only ex-post price information is missing (Treatment 2), as opposed to markets where both persist. This is statistically significant at the 1% level in the REM and at the 10% level for Treatment 1 or the 1% level for Treatment 3, respectively, in the FEM (Table 7).

3.5. Hypothesis 5, Model 5

As outlined before, we also investigated the probability of usage of a pricing strategy called "poaching" (model 3, logit model). The results of model 5 suggest that poaching is used more often in markets with price differentiation whenever ex-post price information is missing than when suppliers have access to ex-post information (the coefficient of Treatment 2 is positive). This holds for the REM (Table 6, at the 1% level) and the FEM (Table 7, at the 1% level), and for periods 9–16 as well as 1–16. Therefore, this finding supports the notion that competition intensity is lower in markets described by Treatment 3 than in Treatment 2. Again, it should be noted that we make no conclusions on Treatment 1 because it was excluded from this part of the analyses. This is because poaching (at least as operationalized in this paper) is not possible in treatments without price differentiation.

4. DISCUSSION

This study explored how fundamental market characteristics in business-to-business contract markets enable tacit coordination through customer-specific mutual forbearance. Our controlled laboratory experiment demonstrates that suppliers implicitly develop "customer ownership" norms when ex-post contract information and customer-specific pricing capabilities coincide – effectively treating individual customers as separate market spheres rather than competing uniformly across all buyers.

Our analysis provides support for all five hypotheses. The results suggest that mutual forbearance can be observed if price differentiation and ex-post information on transaction prices and relationships coincide, leading to fewer customer-supplier switches, higher offer and transaction prices, and less poaching. However, if one of the two elements was missing, competitive intensity was not reduced to the same extent.

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The combination of information transparency and pricing flexibility creates a fundamentally different competitive dynamic than traditional uniform-pricing oligopolies. When suppliers can observe rival contract prices and relationships ex-post while maintaining customer-specific pricing capabilities, they develop implicit territorial understandings without explicit communication. This supports the multimarket contact logic extended to the customer level: each customer relationship functions as a quasi-independent submarket where suppliers calculate retaliation risks across their entire customer portfolio.

Our results align with previous market experiments on multimarket contact effects. Similar to Feinberg and Sherman (1988) and Phillips and Mason (1992), we found evidence that multimarket contact reduces competitive intensity. This occurs because each supplier has a potential "foothold" (Karnani & Wernerfelt, 1985) in competitors' markets, as market entry through customer switching does not require timely, upfront investment. In each period, suppliers can decide anew to conquer or retaliate in specific customer markets through lower pricing; thus, even the potential presence in a customer market may be sufficient to establish cooperative outcomes.

The timing effects we observed – with mutual forbearance emerging primarily in settled markets (periods 9–16) – suggest two opposing forces at work. Early in market interaction, competitive customer acquisition incentives dominate. However, as margins erode and relationships stabilize, the forbearance effect becomes stronger than the acquisition effect. This pattern aligns with industrial organization theory, suggesting that coordination mechanisms require time to develop and become credible (Green & Porter, 1984; Bigoni et al., 2019).

Our results support Stigler's (1964) information-facilitates-coordination hypothesis in customer-specific settings, while contradicting Vega-Redondo's (1997) competition-intensifies-with-information prediction. The difference likely stems from our focus on ex-post contract information rather than profit information, reducing imitation incentives while enhancing monitoring capabilities for territorial violations.

Furthermore, our results support previous experimental research, including Feinberg and Snyder (2002) and Holcomb and Nelson (1997), who found that markets with perfect information were more collusive than those with imperfect information. However, we cannot support the experimental findings of Huck et al. (2000), who found no significant difference in competitive intensity with complete versus incomplete information about rivals' actions and profits. This contradiction may stem from the role of profit information: while Vega-Redondo (1997) and Huck et al. (2000) emphasized profit-based imitation of successful rivals, our experiment never explicitly revealed competitors' profits, rendering imitation less important than territorial monitoring.

The findings of our study also bridge behavior-based price discrimination literature with multimarket contact theory. While Chen (1997) and Pazgal and Soberman (2008) predicted that discrimination intensifies competition and leads to lower prices, our results confirm Horstmann and Kraemer's (2013) experimental evidence that discrimination can facilitate coordination – but only when combined with appropriate information structures. The customer-specific nature of contracts enables targeted retaliation mechanisms that make territorial agreements self-enforcing.

Our experimental design, while robust, focused on posted-offer price competition to best reflect contract market conditions and maintain manageable complexity. Future research could expand on this by exploring double-auction or quantity competition, incorporating capacity constraints, demand elasticity, and real buyers instead of automated agents to investigate alternative coordination mechanisms. Field studies leveraging natural or quasi-experiments – especially when technological shifts affect contracting or information – could help test the customer-as-markets framework in practice and examine moderating effects such as relationship duration, switching costs, or market concentration. Theoretical advances might also model the dynamic evolution of customer ownership norms and boundary negotiation processes, providing further strategic insights.

CONCLUSION

The objective of this study was to examine how the combination of ex-post information and customer-specific pricing affects competitive dynamics in B2B oligopoly contract markets. The experimental results show that when both factors coincide, suppliers develop implicit customer ownership norms, resulting in fewer customer-supplier switches, higher prices, and less aggressive poaching. These findings indicate that strategic use of information transparency and pricing flexibility enables tacit coordination and sustainable profitability, whereas the absence of either element leads to intensified competition.

The results provide actionable guidance for B2B managers: Focusing resources on market intelligence and customer relationships can enable firms to sustain profitable segments and avoid destabilizing price wars. Rather than competing across the board, selectively prioritizing key customers and treating them as distinct market spheres helps maintain higher prices and stable market positions. This "customers-as-markets" perspective is increasingly relevant in modern B2B environments, where flexible contracting and strategic coordination shape lasting competitive advantage.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Anderson, J. C., & Narus, J. A. (2004). *Business market management: Understanding, creating, and delivering value* (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
2. Areeda, P., & Turner, D. (1979). Conglomerate mergers: Extended interdependence and effects on interindustry competition as grounds for condemnation. *University of Pennsylvania Law Review, 127*(4), 1082-1103. https://doi.org/10.2307/3311793
3. Bakos, Y. (1998). The emerging role of electronic marketplaces on the Internet. *Communications of the ACM, 41*(8), 35-42. https://doi.org/10.1145/280324.280330
4. Bernheim, B. D., & Whinston, M. D. (1990). Multimarket contact and collusive behavior. *The RAND Journal of Economics, 21*(1), 1-26. Retrieved from https://www.jstor.org/stable/2555490
5. Bigoni, M., Potters, J., & Spagnolo, G. (2019). Frequency of interaction, communication and collusion: An experiment. *Economic Theory, 68*(4), 827-844. https://doi.org/10.1007/s00199-018-1146-4
6. Boeker, W., Goodstein, J., Stephan, J., & Murmann, J. P. (1997). Competition in a multimarket environment: The case of market exit. *Organization Science, 8*(2), 126-142. https://doi.org/10.1287/orsc.8.2.126
7. Brokešová, Z., Deck, C., & Peliova, J. (2014). Experimenting with purchase history based price discrimination. *International Journal of Industrial Organization, 37,* 229-237. https://doi.org/10.1016/j.ijindorg.2014.10.003
8. Brown-Kruse, J. L. (1991). Contestability in the presence of an alternate market: An experimental examination. *The RAND Journal of Economics*, *22*(1), 136-147. Retrieved from https://www.jstor.org/stable/2601012
9. Brown-Kruse, J., Rassenti, S., Reynolds, S. S., & Smith, V. L. (1994). Bertrand-Edgeworth competition in experimental markets.

http://dx.doi.org/10.21511/ppm.24(1).2026.23

Econometrica, 62(2), 343-371. https://doi.org/10.2307/2951616

10. Buchheit, S., & Feltovich, N. (2011). Experimental evidence of a sunk-cost paradox: A study of pricing behavior in Bertrand-Edgeworth duopoly. *International Economic Review, 52*(2), 317-347. https://doi.org/10.1111/j.1468-2354.2011.00630.x
11. Carlton, D. W., & Perloff, J. M. (2015). *Modern industrial organization* (4th ed.). Boston: Pearson.
12. Chen, Y. (1997). Paying customers to switch. *Journal of Economics & Management Strategy, 6*(4), 877-897. https://doi.org/10.1111/j.1430-9134.1997.00877.x
13. Committee on Publication Ethics (COPE). (1999). *Committee on Publication Ethics: the COPE Report 1999. Guidelines on good publication practice* (pp. 43-47). London: BMJ Books. Retrieved from https://oem.bmj.com/content/57/8/506
14. Corts, K. S. (1998). Third-degree price discrimination in oligopoly: All-out competition and strategic commitment. *The Rand Journal of Economics*, *29*(2), 306-323. Retrieved from https://www.jstor.org/stable/2555890
15. Dekeyser, S., Gaeremynck, A., Knechel, W. R., & Willekens, M. (2021). Multimarket contact and mutual forbearance in audit markets. *Journal of Accounting Research, 59*(5), 1651-1688. https://doi.org/10.1111/1475-679X.12406
16. Dolbear, F. T., Lave, L. B., Bowman, G., Lieberman, A., Prescott, E., Rueter, F., & Sherman, R. (1968). Collusion in oligopoly: An experiment on the effect of numbers and information. *The Quarterly Journal of Economics, 82*(2), 240-259. https://doi.org/10.2307/1885896
17. Durham, Y., McCabe, K., Olson, M. A., Rassenti, S., & Smith, V. (2004). Oligopoly competition in fixed cost environments. *International Journal of Industrial Organization, 22*(2), 147-162. https://doi.org/10.1016/j.ijindorg.2003.06.002
18. Edwards, C. D. (1955). Conglomerate bigness as a source of power. In G. J. Stigler (Ed.), *Business concentration and price policy* (pp. 331-359). Princeton, NJ: Princeton University Press. Retrieved from https://www.nber.org/system/files/chapters/c0967/c0967.pdf
19. Feinberg, R. M. (1984). Mutual forbearance as an extension of oligopoly theory. *Journal of Economics and Business, 36*(2), 243-249. https://doi.org/10.1016/0148-6195(84)90035-3
20. Feinberg, R. M., & Sherman, R. (1988). Mutual forbearance under experimental conditions. *Southern Economic Journal, 54*(4), 985-993. https://doi.org/10.2307/1059532
21. Feinberg, R., & Snyder, C. (2002). Collusion with secret price cuts: An experimental investigation. *Economics Bulletin, 3*(6), 1-11. Retrieved from https://core.ac.uk/download/pdf/6421346.pdf
22. Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics, 10*(2), 171-178. https://doi.org/10.1007/s10683-006-9159-4
23. Fonseca, M. A., & Normann, H.-T. (2008). Mergers, asymmetries and collusion: Experimental evidence. *The Economic Journal, 118*(527), 387-400. https://doi.org/10.1111/j.1468-0297.2007.02126.x
24. Fouraker, L. E., & Siegel, S. (1963). *Bargaining behavior*. New York: McGraw Hill.
25. Fourberg, N. (2023). Let's lock them in: Collusion under consumer switching costs. *International Journal of Industrial Organization, 91,* 103018. https://doi.org/10.1016/j.ijindorg.2023.103018
26. Fudenberg, D., & Tirole, J. (2000). Customer poaching and brand switching. *The Rand Journal of Economics, 31*(4), 634-657. Retrieved from https://www.jstor.org/stable/2696352
27. Fudenberg, D., & Villas-Boas, J.M. (2006). Behavior-based price discrimination and customer recognition. In T. Hendershott (Ed.), *Handbook on economics and information systems* (vol. 1, pp. 377-436). Amsterdam: Elsevier. Retrieved from https://faculty.haas.berkeley.edu/VILLAS/surveypaper9-06.pdf
28. Gehrig, T.P., & Stenbacka, R. (2005). Price discrimination, competition and antitrust. In M. Bergman (Ed.), *The pros and cons of price discrimination* (pp. 131-160). Stockholm: Swedish Competition Authority (Konkurrensverket). Retrieved from https://www.konkurrensverket.se/globalassets/dokument/informationsmaterial/rapporter-och-broschyrer/pros-and-cons/rapport_pros-and-cons_2005_the-pros-and-cons-of-price-discrimination.pdf
29. Gilbert, R. J., & Lieberman, M. (1987). Investment and coordination in oligopolistic industries. *The RAND Journal of Economics, 18*(1), 17-33. Retrieved from https://www.jstor.org/stable/2555532
30. Green, E. J., & Porter, R. H. (1984). Noncooperative collusion under imperfect price information. *Econometrica, 52*(1), 87-100. https://doi.org/10.2307/1911462
31. Greiner, B. (2004). An online recruitment system for economic experiments. In K. Kremer & V. Macho (Eds.), *Forschung und Wissenschaftliches Rechnen 2003, GWDG-Bericht 63* (pp. 79-93). Göttingen: Gesellschaft für wissenschaftliche Datenverarbeitung. Retrieved from https://mpra.ub.uni-muenchen.de/13513/
32. Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271. https://doi.org/10.2307/1913827
33. Hay, G. A., & Kelley, D. (1974). An empirical survey of price fixing conspiracies. *The Journal of Law and Economics, 17*(1), 13-38. https://doi.org/10.1086/466782
34. Holcomb, J. H., & Nelson, P. S. (1997). The role of monitoring in duopoly market outcomes. *The Journal of Socio-Economics, 26*(1), 79-93. https://doi.org/10.1016/S1053-5357(97)90053-6
35. Horstmann, N., & Kraemer, J. (2013). Price discrimination or uniform pricing: Which colludes more? *Economic Letters, 120*(3), 379-383. https://doi.org/10.1016/j.econlet.2013.05.011

36. Huck, S., Normann, H. T., & Oechssler, J. (2000). Does information about competitors' actions increase or decrease competition in experimental oligopoly markets? *International Journal of Industrial Organization, 18*(1), 39-57. https://doi.org/10.1016/S0167-7187(99)00033-8

37. Huck, S., Normann, H. T., & Oechssler, J. (2004). Two are few and four are many: Number effects in experimental oligopolies. *Journal of Economic Behavior & Organization, 53*(4), 435-446. https://doi.org/10.1016/j.jebo.2002.10.002

38. Karnani, A., & Wernerfelt, B. (1985). Multiple point competition. *Strategic Management Journal, 6*(1), 87-96. https://doi.org/10.1002/smj.4250060107

39. Klemperer, P. (1995). Competition when consumers have switching costs: An overview with applications to industrial organization, macroeconomics, and international trade. *The Review of Economic Studies, 62*(4), 515-539. https://doi.org/10.2307/2298075

40. Leibbrandt, A. (2020). Behavioral constraints on price discrimination: Experimental evidence on pricing and customer antagonism. *European Economic Review, 121,* Article 103303. https://doi.org/10.1016/j.euroecorev.2019.103303

41. Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *The Annals of mathematical Statistics, 18*(1), 50-60. Retrieved from https://www.jstor.org/stable/2236101

42. Nawaz, R. R., & Wagner, R. (2025). Disclosing transparency: A review of B2B marketing and supply chain research. *Industrial Marketing Management, 124,* 73-94. https://doi.org/10.1016/j.indmarman.2024.11.011

43. Orzen, H., & Sefton, M. (2008). An experiment on spatial price competition. *International Journal of Industrial Organization, 26*(3), 716-729. https://doi.org/10.1016/j.ijindorg.2007.05.007

44. Pazgal, A., & Soberman, D. (2008). Behavior-based discrimination: Is it a winning play, and if so, when? *Marketing Science, 27*(6), 977-994. https://doi.org/10.1287/mksc.1070.0355

45. Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies, 22*(1), 435-480. https://doi.org/10.1093/rfs/hhn053

46. Phillips, O. R., & Mason, C. F. (1992). Mutual forbearance in experimental conglomerate markets. *The Rand Journal of Economics, 23*(3), 395-414. Retrieved from https://www.jstor.org/stable/2555870

47. Satterthwaite, F. E. (1946). An approximate distribution of estimates of variance components. *Biometrics Bulletin, 2*(6), 110-114. https://doi.org/10.2307/3002019

48. Schendera, C. F. G. (2008). *Regressionsanalyse mit SPSS [Regression analysis with SPSS]* (1st ed). Berlin: De Gruyter Oldenbourg. (In German).

49. Schmalensee, R., & Willig, R. D. (Eds.). (1989). *Handbook of industrial organization* (Vols. 1 & 2). Amsterdam: North-Holland/Elsevier.

50. Stigler, G. J. (1964). A theory of oligopoly. *Journal of Political Economy, 72*(1), 44-61. https://doi.org/10.1086/258853

51. Stoecker, R. (1980). *Experimentelle Untersuchung des Entscheidungsverhaltens im Bertrand-Oligopol [Experimental investigation of decision behavior in a Betrand oligopoly].* PUB, Publikationen an der Universität Bielefeld. (In German).

52. Thisse, J.-F., & Vives, X. (1988). On the strategic choice of spatial price policy. *The American Economic Review, 78*(1), 122-137. Retrieved from http://www.jstor.org/stable/1814702

53. Umezawa, M. (2022). Behavior-based price discrimination in a horizontally and vertically differentiated duopoly with switching costs. *Information Economics and Policy, 61,* Article 101004. https://doi.org/10.1016/j.infoecopol.2022.101004

54. Umezawa, M., & Yamakawa, S. (2025). The impact of switching costs on behavior-based price discrimination with multiple consumer types. *Journal of Economics, 145*(2), 147-187. https://doi.org/10.1007/s00712-025-00900-6

55. Vega-Redondo, F. (1997). The evolution of Walrasian behavior. *Econometrica, 65*(2), 375-384. https://doi.org/10.2307/2171898

56. Welch, B. L. (1951). On the comparison of several mean values: An alternative approach. *Biometrika, 38*(3/4), 330-336. https://doi.org/10.2307/2332579

57. Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics Bulletin, 1*(6), 80-83. https://doi.org/10.2307/3001968

58. Wooldridge, J. M. (2014). *Introduction to econometrics*. Boston: Cengage Learning.

http://dx.doi.org/10.21511/ppm.24(1).2026.23

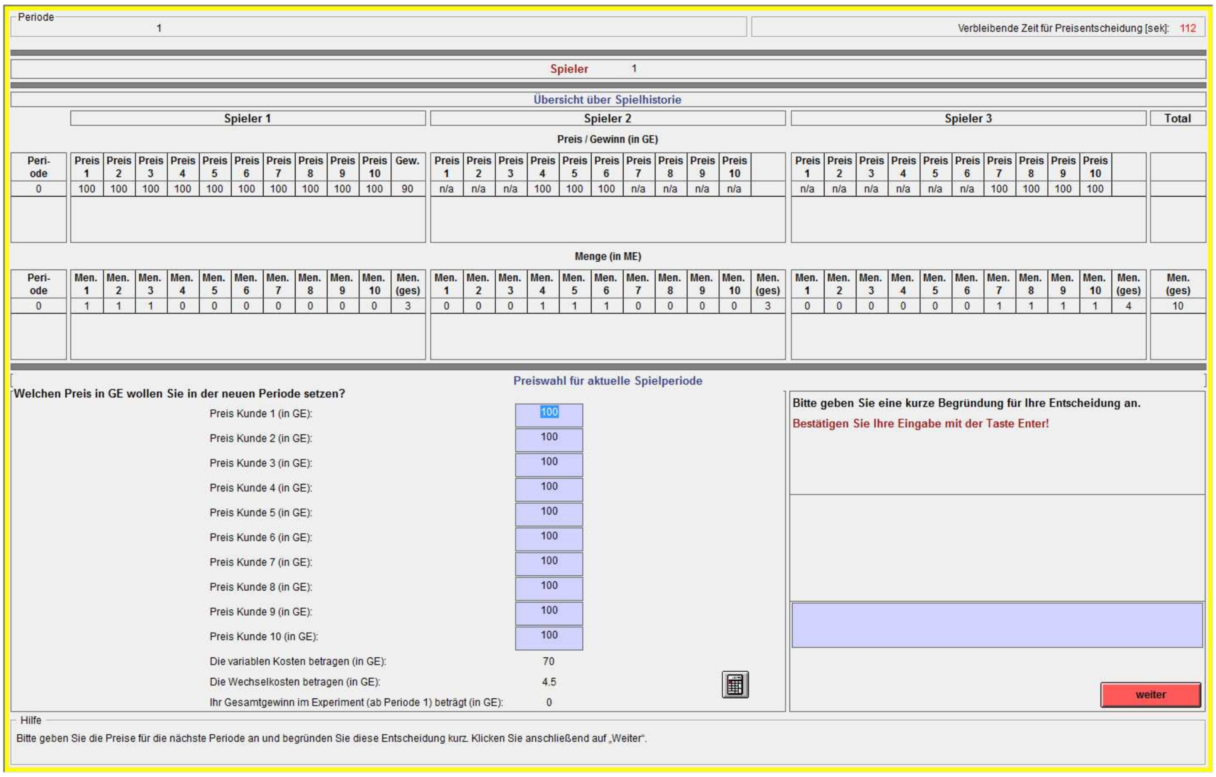
APPENDIX A

EXPERIMENTAL INSTRUCTIONS

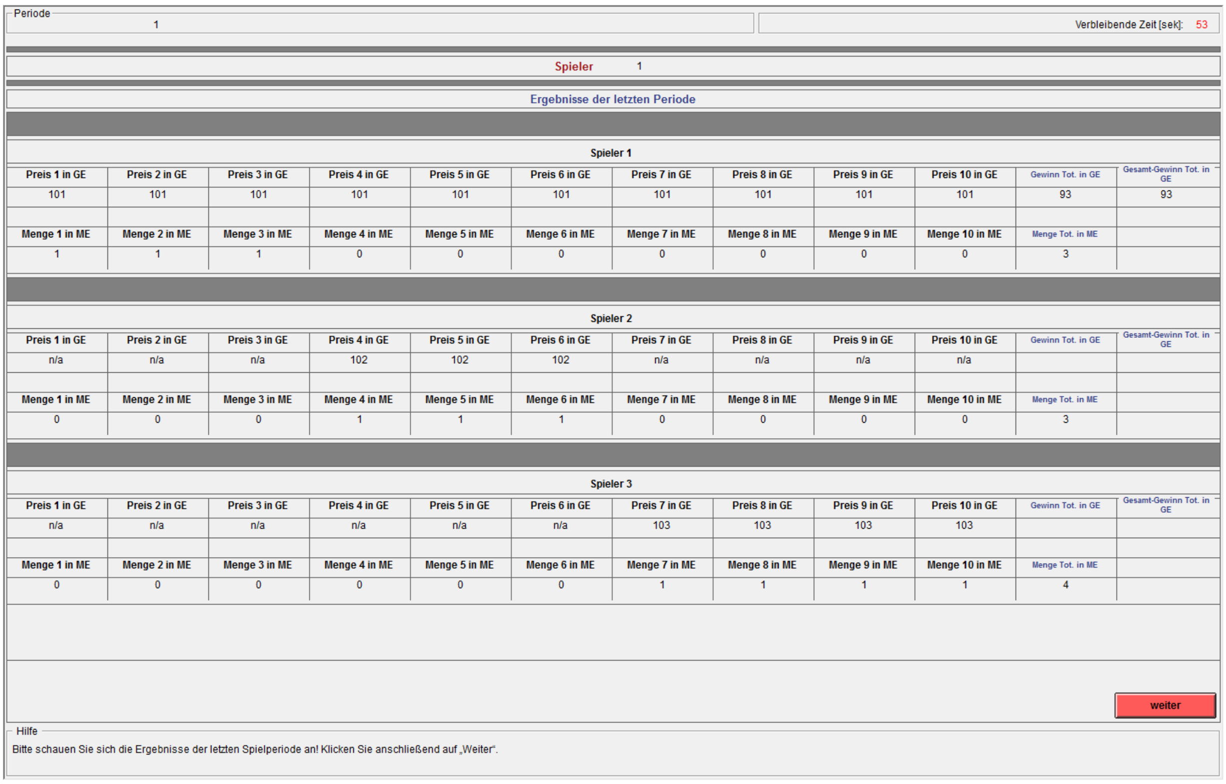
The following experimental instructions (translated from German) are for Treatment 3 (price differentiation and ex-post information on prices as well as supplier-buyer relationships). The instructions for the other treatments are identical except for treatment specifics.

- **Description of market environment**
  - The market comprises three (3) suppliers/firms and ten (10) customers who always demand exactly one unit (ME) of a homogenous (identical) good. (Demand does not change during the experiment.)
  - The participant is a supplier/firm in this market.
  - In the initial situation (period 0), each supplier was able to win certain customers: Firm 1 = 3 customers (1–3); Firm 2 = 3 customers (4–6); Firm 3 = 4 customers (7–10).
  - When a customer switches a supplier (seller) from the previous round, the customer incurs costs (e.g., for upgrading machinery, amounting to 4.5 currency units [CU] [switching costs]).
  - Customers always buy from the least expensive supplier, taking into account potential switching costs. If a customer finds a new supplier that sells the product for 5 CU or cheaper, the customer switches (price difference of 5 CU or more required). If the price discrepancy is only 4 CU, the customer does not switch to the new supplier.
  - One unit (ME) of the good costs 70 CU in production (variable costs); additional costs (such as fixed costs) do not exist.
  - At the beginning, the price for one unit of the good is 100 CU for all customers.
  - In each round, suppliers produce as much as is demanded by customers (i.e., the supplier is able to serve all customers and faces no over-production).
- **Course of the periods**
  - The game consists of several periods; the exact number is unknown. The game ends automatically.
  - In each round, the supplier (seller) must determine the price for one unit (ME) of the good; thereby, the supplier has the opportunity to offer each customer an individual price (price discrimination). The supplier is provided with a corresponding input mask.
  - The selected prices must be positive integers (1, 2, 3...).
  - At the same time, the supplier must enter a short explanation of their behavior in the provided text box (the “Enter” key must be pressed after the information is entered).
  - Afterward, the supplier confirms the entries for the period with the “Next” key on the screen.
  - At the end of each round, after the results have been calculated, they are displayed to the supplier on the output mask/results screen.
  - Explicit communication between the sellers is prohibited at any time during the experiment.

- **Input mask**



- **Output mask/results screen**



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- **Goal of the game**
  - The supplier's (seller's) goal is to maximize the accumulated profit (sum of all period profits) over the duration of the experiment.
  - In general, each additional CU the supplier wins during the game leads to a higher payoff (i.e., the better the supplier plays the higher the payout at the end).
  - The payout is calculated as fixed amount + accumulated profit converted to EUR, whereas:
  - Fixed amount: lump sum of 5 EUR.
  - Accumulated profit: profit over all periods converted by an exchange rate of 20 CU = 1 EUR (0.05 EUR/CU).
  - Payment to the supplier is made on site directly after the experiment.
  - Please note: We are not able to pay out more than 30 EUR per person.

END