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## Group-buying and channel coordination under asymmetric information

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### ABSTRACT

Social media and improvements in technology allow retailers to offer a group-buying option to consumers in a variety of markets. Extant research shows that when consumers are sufficiently heterogeneous, group-buying helps a *retailer* practice price discrimination. Our paper examines when a *manufacturer* may prefer its reseller to employ the group-buying mechanism in conjunction with a traditional posted price. In our model, the retailer is privately informed about market heterogeneity, which is summarized via the relative size and the level of price sensitivity of two consumer segments. We show that any value to the manufacturer, of requiring the retailer to offer group-buying, revolves around how profitability varies with market heterogeneity. Our principal finding is that group-buying benefits the manufacturer more when the retailer is privately informed about market size than about the level of consumer price sensitivity.

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## 1. Introduction

Group-buying (*GB*) is an evolving business model in which firms offer discounted prices to encourage individual consumers to join buying-groups. This practice is observed in a variety of product categories, ranging from consumer electronics and furniture to dental services and museum visits (Edelman, Saffe, & Kominers, 2016). Recent work has focused on consumer behavior related to *GB* (e.g., Liang, Ma, Xie, and Yan, 2014; Luo, Andrews, Song, and Aspara, 2014; Kauffman & Wang, 2001; Kauffman & Wang 2002). Researchers have explored how *GB* may motivate consumers to share information and educate others about firms' products via social media (Jing & Xie, 2011), and help retailers implement price discrimination either when consumers have heterogeneous product valuations (Edelman et al., 2016) or when market demand is uncertain (Anand & Aron, 2003).

While its value to retailers seems to be promising – as evidenced, e.g., by more than 400 different *GB* sites (Edelman et al., 2016) and the \$6 billion acquisition offer made by Google in 2010 (MacMillan & Galante, 2010) – it is unclear how upstream distribution channel members may benefit from *GB*. In fact, some manufacturers, such as Kohler, Estee Lauder and Cartier, do not

support this practice and others actively discourage their retailers from offering a *GB* option (Tang, 2008; Areddy 2006). These examples suggest that among the many tools available to manufacturers to better coordinate their channels – such as using cost/revenue sharing and consignment contracts (see e.g., Linh and Hong, 2009; Zhang, de Matta, and Lowe, 2010a; Sheu, 2011; Kunter, 2012) or employing resale price maintenance (where suppliers directly control a reseller's final price; see e.g., Rey and Tirole, 1986; Mathewson and Winter, 1998; Lindsay, 2007) – manufacturers may also have an interest in controlling the *pricing mechanism* that the reseller employs. Limited research attention, however, has been directed at the latter issue, and our goal is to explore the conditions under which a manufacturer may prefer its reseller to offer *GB*.

We develop a mathematical model, in which a manufacturer distributes its product via a retailer who, in addition to selling the product at a 'traditional' posted price, may be allowed by the manufacturer to offer consumers *GB* as an option. Because *GB*'s value hinges on the level of demand heterogeneity (Anand and Aron, 2003; Edelman et al., 2016; Chen, Chen, & Song, 2007), our model focuses on a market with two segments, which vary in their relative size and the level of consumers' price sensitivity. Further, due to the rapidly changing nature of today's retail environment, the reseller is assumed to be better informed (than the manufacturer) about the market characteristics. For instance, though the manufacturer may know the size and the (average) price sensitivity of

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the overall market, the retailer has more precise knowledge of the characteristics of each market segment<sup>1</sup>.

Our analysis compares two settings: (1) a benchmark scenario, where the manufacturer and retailer are both fully informed about the segment characteristics; and (2) the retailer has better information than the manufacturer – in this setting, to highlight an important distinction between the two types of market information, we allow the retailer to be better informed on one segment characteristic at a time. The advantage arising from being privately informed about the market sets the stage for the retailer to command rents and allows us to examine the conditions where the manufacturer may leverage *GB* to improve channel coordination and profitability.

Compared to posted pricing, even the most simplified *GB* format – i.e., with a single price tier as featured on Groupon (in contrast to other formats of *GB* with multiple price tiers; see [Chen et al., 2007](#)) – requires some extra effort on the part of consumers ([Luo et al., 2014](#); [Jing & Xie, 2011](#)). For instance, consumers have to devote time to join *GB* and wait to receive the confirmation on the discounted price prior to being able to redeem it. Such an inconvenience is costly, and to ensure their participation, the retailer must compensate consumers for this cost. Even then, only those who are sufficiently price-sensitive may be interested in joining *GB* while the less price-sensitive consumers would likely prefer to buy at the posted price. Accordingly, the retailer must evaluate the relative magnitude of the above mentioned costs and benefits from *GB*; such benefits tend to go up with the degree of market heterogeneity – i.e., (i) when the size of the less price-sensitive segment becomes relatively larger, and/or (ii) the level of sensitivity of the more price-sensitive segment goes up.

In our model, we expand the contract terms between the manufacturer and the retailer from a *wholesale price and fixed fee* combination to include the pricing mechanism the retailer should employ (i.e., requiring the retailer to sell only at a posted price or with *GB* as an additional option); we do this to explore the optimality of the manufacturers' behavior outlined in our anecdotal examples. Our analysis of the benchmark setting, where there is no information asymmetry between the manufacturer and the retailer, reveals that *GB*'s value goes up with market heterogeneity (as reflected in the two conditions noted at the end of the previous paragraph); when such conditions are not met, the manufacturer will insist on using only posted pricing.

When privately informed about the local market, the retailer can claim to be in a less favorable setting with the hope of obtaining more advantageous contract terms (e.g., lower wholesale price) from the manufacturer. The principal contribution of our analysis is that we identify when the manufacturer may leverage *GB* to eliminate such discretionary behavior. Our analysis reveals that the extent to which the manufacturer can achieve channel coordination and regain profit – in other words, eliminate the potential loss due to asymmetric information – depends on the type of information that is privately known to the retailer: if the private information is about the relative sizes of the segments, then information asymmetry ceases to bind on the manufacturer. Such an outcome does not arise when the retailer is privately informed about the segments' price sensitivities.

To understand the rationale behind these results, notice that the profitability of using a single posted price is determined by the size of the entire market and remains unchanged in the relative sizes of the two segments. By contrast, using *GB* (in addition to a posted price) is more profitable when the less price-sensitive segment be-

comes relatively larger. Therefore, when information asymmetry is about the sizes of the segments, the manufacturer can eliminate the retailer's discretionary behavior by using a menu of contracts: one of which includes *GB* as an additional option to posted pricing and features a higher wholesale price; and the other contract requires only posted pricing but features a lower wholesale price. The former contract is designed for a setting where the less price-sensitive segment is relatively large. In this more favorable market condition, using *GB* gives more retail profit, and hence, allows for a higher wholesale price. By contrast, the latter contract works well when the less price-sensitive segment is relatively small; the manufacturer accommodates this unfavorable market condition via a lower wholesale price, allowing the retailer to earn higher profit when using a single posted price. Given this menu, lying about the state of the nature does not benefit the retailer – e.g., if the market happens to be in the favorable state, choosing the 'unfavorable' contract requires using only posted pricing and that option limits the retailer's profit!

Now, if the retailer were privately informed about the level of price sensitivity of each market segment, the manufacturer is forced to cede some rents to the retailer. This is due to the fact that retail profit – under both pricing mechanisms: (1) posted pricing, and (2) *GB* in addition to posted pricing – now varies with the realization of consumers' price sensitivities. Specifically, when the market is favorable and consumers – especially those in the more price-sensitive segment – become less sensitive to the price, the retailer earns higher profit with either pricing mechanism. As a result, inducing the retailer to choose the desired pricing mechanism in this state becomes more costly to the manufacturer and the full-information solution cannot be regained. In the paper, we elaborate on the above intuition and derive the precise conditions under which *GB* benefits the manufacturer.

Our paper contributes to the literature on group-buying by exploring how group-buying affects information sharing and differentially benefits various members of the distribution channel. Specifically, we examine the implications of the different types of changes in market characteristics (and the information about these changes) on the retailer's incentives to use *GB* and the manufacturer's profitability. Our work complements the current research on the informational aspects of group-buying, which focuses on the dynamics of group-buying and its benefits to the consumers ([Liang et al., 2014](#); [Kauffman & Wang, 2001](#)) and the retailers ([Jing and Xie, 2011](#); [Anand and Aron, 2003](#), among others).

Based on their survey of senior executives, [Narayanan and Ramann \(2005\)](#) note that supply chain incentives are often mis-aligned due to issues such as hidden information (see also [Kouvelis, Chambers, & Wang, 2006](#)). In that context, our analysis also adds to the literature on channel coordination. A considerable stream of research has identified various approaches to improve channel coordination by using, for instance: quantity discounts (e.g., [Spengler, 1950](#); [Jeuland and Shugan, 1983](#); [Ingene and Parry, 1995](#); [Kumar, Loomba, & Hadjinicola, 2000](#)), cost/revenue sharing and consignment contracts (e.g., [Desai 1997](#), [Linh and Hong, 2009](#); [Zhang et al., 2010a](#); [Sheu, 2011](#); [Kunter, 2012](#)), dual channels ([Chiang, Chhahjed, and Hess, 2003](#); [Rodriguez and Aydin, 2015](#); [Cao, So, & Yin, 2016](#)), among others. Our analysis complements the above literature and shows how *GB* may help improve coordination under information asymmetry when adverse selection can negatively impact effective channel management.

The rest of this paper is organized as follows. [Section 2](#) describes the basic elements of our model. [Section 3](#) analyzes the full-information setting and derives the optimal contract that the manufacturer will offer to the retailer, contingent on the different realizations of the sizes, and price sensitivities of the market segments. [Sections 4](#) and [5](#) explore the two settings of asymmetric information regarding the sizes and price sensitivities of the

<sup>1</sup> Dealing with information asymmetry has been a long standing issue in the channel and supply-chain management literature; see, e.g., [Dukes, Gal-Or, and Geylani \(2011\)](#), [Mishra and Prasad \(2005\)](#), [Bolton and Dewatripont \(2005\)](#), [Narayanan and Raman \(2005\)](#), among others.

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