

# Retail Market Power in a Shopping Basket Model of Supermarket Competition<sup>☆</sup>

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## Abstract

Supermarket retailers typically operate with relatively low margins, suggesting a highly competitive retail environment. However, despite the fact that consumers purchase an entire shopping basket at a time from supermarkets, this evidence is largely based on models of retail competition with single-category purchases. In this paper, we develop and test an empirical model of retail price competition that explicitly accounts for the effect of demand complementarity among items in consumer shopping baskets. Relative to the case where consumers purchase products with independent demands, we demonstrate that equilibrium prices are higher for all items when retailers take demand-complementarity into account. Our findings indicate that non-price strategies intended to encourage complementarity, such as co-merchandising, strategic shelf-positioning, or featuring complementary goods tend to soften price competition, and lead to higher equilibrium prices.

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## Introduction

As the trend towards consolidation continues among some of the largest retailers in the US – Walmart, Target, and most recently Amazon – there is a growing concern regarding the extent of retail competition (Hosken et al., 2012; Hosken, Olson, and Smith 2012). Yet, an abundance of evidence suggests that retailing remains highly competitive in most markets, particularly in the grocery industry. Indeed, net margins in supermarket retailing averaged less than 2.0% in 2014, far lower than net retail margins in other industries (Food Marketing Institute 2017). Much of the theoretical research on retail pricing maintains that this high level of competitiveness is a consequence of retailers'

incentives to reduce prices on complementary goods in order to drive store volume (Smith and Hay 2005; Smith and Thomassen 2012; Stahl 1982). That is, when two or more products are commonly purchased together, retailers have an incentive to reduce prices in one category in order to facilitate cross-category sales. In this paper, we investigate the role of complementary purchases on retail pricing behavior in a model that measures the extent of retail competition at the basket level rather than individual product level. We provide evidence that selling complementary products provides retailers with an incentive to decrease prices to facilitate cross-category sales, but also serves to reduce the extent of retail competition. Notably, our findings indicate that retailers raise prices on products in complementary categories, rather than reducing them, when operating in highly competitive retail markets.

We develop and test a model of retail competition framed around consumers who purchase multiple items at a time in their shopping baskets. This innovation is important for at least two reasons. First, considerable evidence suggests retailers perceive rivalry in terms of attracting customers at the basket level (Bell and Lattin 1998; Bell et al., 1998; Bell, Ho, and Tang 1998;

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Rhee and Bell 2002), which indicates the need to examine the extent of retail competition across multiple categories of goods at once. Second, estimated retail margins from a framework that conceives consumer demand at the shopping-basket level potentially differ from retail margins derived from single-category demand models (Smith 2004).

Our research contributes to a sizable marketing literature that examines the extent of retail competition (Popkowski Leszczyc and Timmermans 1997; Popkowski Leszczyc et al., 2000; Popkowski Leszczyc, Sinha, and Timmermans 2000; Rhee and Bell 2002) and a small, but growing literature on the role of complementarity purchases on store choice (Diehl, van Herpen, and Lambertson 2015). Our point of departure is that we relax the assumption that competition between rival retailers is driven by price outcomes in a single product category (Bucklin and Lattin 1992; Rhee and Bell 2002; Villas-Boas 2007), or by a single price “index” across categories in consumers’ shopping baskets (Fox, Montgomery, and Lodish 2004). We depart from this literature by allowing products in one category to have complementary demand relationships with goods from other categories in consumers’ shopping baskets. Relative to the case of products with independent demands, we demonstrate that complementarity among items in a shopping basket softens price competition between rival retailers.

It is well-known that a monopoly retailer has an incentive to reduce prices on complementary goods to drive cross-category sales. It is also well-known that oligopoly retailers reduce prices below the monopoly level to attract customers from rivals. The novel element of our empirical model is that we show the oligopoly motivation to reduce retail prices relaxes the intensity of price competition when the products in consumers’ shopping baskets are complements in demand (Hamilton and Richards 2018). The intuition behind this hypothesis is straightforward: Competing retailers in a given market have an incentive to lower prices on complementary products in order to build volume from customers already in their stores. Unlike a monopoly-retailer, they also have an incentive to reduce all prices in an attempt to steal business from rivals. But, because margins are lower for all due to the fact that they are trying to drive basket-size through pricing complementary products, there is less incentive to steal low-margin business. As a result, selling complementary products softens price competition. Indeed, we provide evidence that retail prices rise when retailers sell complementary products under conditions of strong competition<sup>1</sup>; that is, the effect of complementary purchases on softening retail competition can overwhelm retailers’ incentives to reduce prices on complementary items to facilitate cross-category sales.

We test the implications of our model using a structural model of multicategory demand, store choice, and equilib-

rium price formation among retailers. Empirical models that examine the extent of retail competition typically assume consumers make discrete choices among products within a category, discrete choices among categories within a retail store, and discrete choices among different retail stores (Bell and Lattin 1998; Bucklin and Lattin 1992; Kumar and Leone 1988). Here, we maintain the assumption that consumers make discrete choices among different retail stores, an outcome that Smith and Thomassen (2012) demonstrate is approximately true, but depart from the conventional approach by considering a shopping-basket model of demand in which consumer choices involve purchasing decisions over multiple product categories at a time. Our demand model is flexible in the sense that it encompasses the entire range of demand relationships from substitutes to complements, which allows us to nest the single-category approach under a restriction of independent demands. The nested structure of our model enables us to conduct a series of counterfactual experiments to demonstrate how equilibrium retail prices vary with the extent of complementarity among products frequently purchased together in consumers’ shopping baskets.

Our empirical approach requires that we jointly estimate demand, and equilibrium retail prices, for at least two categories of products that typically appear together in consumers’ shopping baskets. Because the number of possible shopping baskets a consumer might purchase expands with the square of the number of items considered, the resulting “curse of dimensionality” makes considering all the items that appear in our observed shopping baskets analytically intractable (Kwak, Duvvuri, and Russell 2015). Accordingly, we consider four commonly purchased items: (i) cereal; (ii) milk; (iii) soft drinks; and (iv) snacks. In choosing these categories, we do not attempt to completely describe all shopping baskets, but rather to show that equilibrium prices are likely to differ between single-category and multicategory models when consumers purchase products that are complementarity in demand.

Our findings provide novel insights into how retailers compete, based not only on the proximity of their competitors but also on the relationship between products they sell. Analytically, we show that rival stores that sell baskets of complementarity goods can be expected to compete less intensively than stores that sell baskets of goods that are independent in demand, providing empirical support for the hypothesis that selling complementary products softens retail price competition. We then conduct a numerical simulation in which we hold everything else constant apart from demand relationships between products, and then vary the degree of complementarity among items in the shopping basket. Relative to the case of independent goods, our numerical model reveals that retail prices rise with the degree of demand complementarity in consumers’ shopping baskets in the interesting case in which the extent of retail competition is strong.

Many important retail pricing strategies depend on demand relationships among products in consumers’ shopping baskets. For example, a “loss-leader” pricing strategy (Chevalier, Kashyap and Rossi 2003; Lal and Matutes 1994) raises retail profits when retailers are able to recoup the loss on one product

<sup>1</sup> This outcome is related to the harvest-invest story of Dubé et al. (2009), Dubé, Hitsch and Rossi (2009) and Pavlidis and Ellickson (2012) in which retailers compete relatively more intensively in order to earn loyal, high-margin customers. Here, complementary products do the opposite – raising margins and softening retail competition.

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