

# When Do Upward Product Line Extensions Help Overall Revenue?

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# When Do Upward Product Line Extensions Help Overall Revenue?

## Abstract

Firms have been committed to upward product line extensions to achieve gains in brand evaluations and in overall demand. Despite the prevalence of such extensions, previous research has provided little empirical guidance about how upward line extensions substitute for and complement the firm's offerings. To fill this research gap, this study looks at the effects of upwardly extended substitute and complementary products on the firm's revenue from existing primary offerings, utilizing a quasi-experiment to compare customer purchases across the pre- and post-launch of upward line extensions. Contrary to previous research, our results reveal that an upward line extension, if positioned as a substitute, significantly cannibalizes the firm's revenue from existing primary offerings. However, when an upward line extension is positioned as a complement to the existing offering, it helps drive an increase in revenue for the existing offering.

**Keywords:** line extension, product portfolio management, causal effect

**Track:** Product and Brand Management

## 1. Introduction

In an effort to expand sales revenue, meet diverse customer needs, and to achieve greater market share, firms are known to often launch product line extensions, which are vertical or horizontal variants of the firm's existing offering within the same product category. Situations where a firm launches an inferior product line, however, may result in customers switching from superior product lines to the inferior ones (Quelch and Kenny, 1994) thus resulting in dilution of brand perceptions and preferences (Aribarg and Arora, 2008). As a way to mitigate such negative effects of such downward line extensions, it has been suggested that firms launch premium versions of new products when extending the product line (Kotler and Armstrong, 2012). This study aims to address the degree to which such upward line extensions contribute to the firm's sales revenue.

Our research is based on the premise that the decision to introduce an upward line extension as a complement or substitute to the firm's primary offering would be the key factor affecting success/failure of a line extension (Kadiyali et al., 1998). Prior research has found that the new product positioned as a complement to the firm's existing primary offering may increase attractiveness of the primary offering, while a substitute may have the opposite effect (Martin and Stewart, 2001; Shine et al., 2007). Extant research, however, does not provide empirical evidence as to what degree the new product under these two conditions (complementary and substitute) would affect sales revenue from the firm's primary offerings.

In order to address our research question, we use panel data from the quick service restaurant industry. This industry provides a particularly useful context for this study because a firm's upward line extension can be considered an exogenous intervention and, therefore, constitutes a quasi-experiment setting. Quick service restaurants mostly compete with horizontally (as opposed to vertically) differentiated product lines (Reibstein and Gatignon, 1984). This creates an ideal setting for this study as we observe no upward line extension in the industry other than from the firm of our interest during the intervention periods.

The use of a quasi-experiment setting in this study helps replicate a randomized experiment as closely as possible and examine the causal effect of upward line extensions. In our empirical setting, the treated group consists of customers who had purchased the firm's new products after its launch, while the control group consists of customers who did not. We then investigate the pre- and post-launch purchase associated with the firm's existing core

products by the treatment group and compare that to the control group. We also demonstrate the robustness of our findings via a series of analyses to rule out potential self-selection.

## **2. Relevant Literature**

Previous research has documented that a firm generally benefits from horizontally extending its product line, as offering greater product variety helps meet diverse customer needs and achieve gains in brand evaluation (Berger et al., 2007) and market share (Kekre and Srinivasan, 1990; Reddy et al., 1994). When extended vertically, however, line extensions have produced mixed results. If a firm extends its product line to an inferior product, it results in a decrease in brand evaluation and subsequently triggers cannibalization such that customers switch from the superior product lines to the inferior ones (Bayus and Putsis, 1999; Desai, 2001). To avoid such negative returns due to downward line extensions, prior research has suggested that firms implement upward line extensions (Caldieraro et al., 2015; Lei et al., 2008). Although these studies examine the positive effect of upward line extensions on customer brand evaluations, none has used actual sales data to provide empirical insights.

Other literature on brand management suggests that the firm's positioning of a line extension as a complement or substitute to its existing offering can be a key factor in the success or failure of this strategy. When the extensions are similar in type and function to the firm's existing offerings, customers may compare their specific features and decide which one they prefer. In contrast, if positioned as a complement, new products via brand or line extensions likely increase the attractiveness of the firm's existing offerings (Kadiyali et al., 1998; Martin and Stewart, 2001; Shine et al., 2007). These studies, however, focus on the firm's positioning of horizontal line extensions or brand extensions whereby a current brand name is used to enter a completely different category, not on the firm's decision to position upward line extensions as substitutes for, or complements to, the firm's primary offerings.

## **3. Research Setting and Data**

### **3.1 Research setting**

Data for this study were obtained from a quick service restaurant chain with a global presence. Responding to customer needs for quality ingredients, the firm decided to extend its product line and launched an innovative substitute of its existing core products, with an emphasis on the product's higher quality. Two months after the new substitute launch, the firm introduced yet another new gourmet side-dish that complemented the firm's primary offerings. Both products were launched with a national television campaign that highlighted the firm's product makeover into a new gourmet line.

We define the new substitute and complementary products as upward line extensions, as the firm made significant changes not only with respect to their sizes and flavors, but also in terms of product quality. Moreover, both the substitute and complement were priced \$2 higher (a 33.3% and 50.1% increase, respectively) as compared to the existing alternatives of equivalent size. Further, the data correspond to the firm's positioning of substitutability and complementarity in that only 9.0% of the new complement orders were placed without the firm's any existing offering, while 22.8% of the new substitute orders were the sole purchases.

We consider the extensions to be an exogenous intervention that influences customers differently, for the following reasons. First, we observe no upward line extension, except from the firm of our interest, in the market during the sample period. This lack of upward line extensions is consistent with industry practice, whereby firms compete with horizontally differentiated product lines to strengthen their market position. Second, the national television campaign with regard to the firm's menu expansion was not targeted; i.e., different customer segments were not given differential exposure to the campaign.

As we have an exogenous shock due to the firm's marketing decision that potentially influences customers differently, our empirical setting constitutes a quasi-experiment, wherein the treated group consists of those who purchased the new product after the launch and the control group consists of customers who made purchases of the firm's products but had not tried the new product. Under this setup, we compare the pre- and post-launch purchase behavior associated with the firm's existing core products against each other.

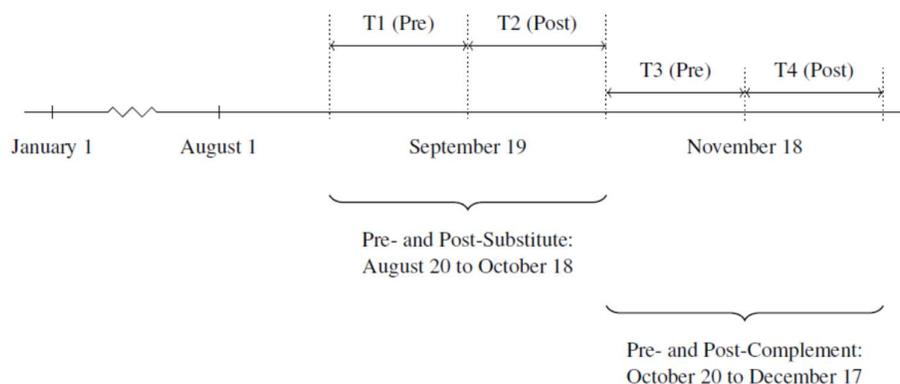
### 3.3 Data description

The data include 446,101 unique customers residing in a Midwestern state of the United States of America. These customers made 851,335 transactions across 80 locations

during a 7-month period. Note that we focus on customers who transacted at least once in both the pre- and post-launch periods during the sample period to ensure full visibility of the customer's purchase from the firm before and after the launch (Manchanda et al., 2015). Further, the designated sample excluding new customers after the launch addresses potential endogeneity concerns that arise from managerial discretion over upward line extensions, e.g., launching a new product to attract new customers and thus increase primary demand.

Figure 1 presents our research design for the new substitute and complement for the firm's upward line extensions. As shown, we first assign the 29-day period before the launch of the new substitute as T1 and the period after the launch as T2. Similarly, we designate the 29-day period before the launch of the new complement for the firm's core products as T3 and the 29-day period after the launch as T4. Note that we balance the observation periods out to 29 days and permit no overlap between the two samples, which results in potential confoundedness due to the two different new product launches.

Figure 1: Pre- and Post-Launch Periods Design



#### 4. Model

This section describes the modeling approach employed to estimate the causal effect of the firm's upward line extensions on the purchase amount and frequency. Under the quasi-experiment setting described in Section 3, we compare the observed changes in purchase behavior from the treatment groups pre- and post-launch of the upward line extensions, to the

corresponding changes in the control groups. This difference-in-differences approach circumvents possible endogeneity concerns that arise when making comparisons between before and after an intervention (Bertland et al., 2004). In particular, the presence of control groups allows us to control for such factors as market-specific characteristics and promotional activities from competitors, which could have changed customer spending over time.

In our empirical setting, we aggregate the transaction details from the pre- and post-launch periods at the individual customer level, rather than leveraging a more fragmented time-series form, to mitigate potential serial correlation and grouped error term effects (Manchanda et al., 2015). Let  $R_{igt}$  be the business outcome measures of interest (i.e., the total and average amount of purchase and the average interpurchase time in log form) for customer  $i$  in group  $g \in \{\text{Treatment, Control}\}$  at time  $t \in \{T1(T3), T2(T4)\}$ . Then

$$R_{igt} = \beta_0 + \beta_1 I_g + \beta_2 I_t + \beta_3 I_g I_t + \varepsilon_{igt}$$

where  $I_g$  and  $I_t$  are the group- and time-specific indicator variables. As such,  $\beta_1$  and  $\beta_2$  capture the systematic difference across the groups (i.e., treatment and control groups) and time periods (i.e., before and after the new product launch), respectively.  $\beta_3$  estimates the causal effect of treatment under the systematic differences and biases across the two different groups and time periods that are being controlled for. That said, the model includes two main effects for group and period and an interaction term that indicates observations from the treatment group post-launch. The error term  $\varepsilon_{igt} \sim N(0,1)$  captures unobservable idiosyncratic taste of customer  $i$  in group  $g$  at time  $t$ .

## 5. Results and Discussion

As shown in Table 1, the results reveal that the treatment effect of the new substitute launch on the total purchase amount of the firm's existing primary offerings is negative and significant, which translates to a 42.8% decrease in the revenue from the existing core products. Such risk of cannibalization illustrates that, contrary to the findings of previous experimental studies (e.g., Lei et al., 2008; Heath et al., 2011), upward line extensions, if positioned as a substitute for the firm's existing offerings, do not necessarily lead to better outcomes for the firm than do downward line extensions. We find that the revenue loss is

attributable to customers switching from the inferior existing products with higher prices (e.g., larger sizes, more flavors) to the new substitute and thus spending less on the existing offerings in each order, while such negative outcomes can be mitigated, to some extent, by the increase in purchase frequency.

We also find that the new complement launch benefits the firm as customers increase the total purchase amount of the firm's existing offerings per order after the launch, resulting in an 11.8% improvement in the revenue from the core products. Although such an increase in the revenue from the core products comes with a decrease in spending on the core products in each order, the complement significantly reduces the interpurchase time after the launch. This suggests that customers likely reduce their average spending on the core products to cover up the price increase of complementary products, but the complement increases the attractiveness of the core products, leading customers to purchase them more frequently. Together, the risk of cannibalization still exists even for upward line extensions, if positioned as a substitute for the firm's existing offerings. Further, the outperformance of upward line extensions to the complement as compared to the substitute is in line with the findings from previous brand extension and horizontal line extension studies.

Given that our data do not originate from a setting characterized by perfect randomization (e.g., a field experiment), a potential concern with the analysis above is that customers in the treatment group may not be strictly comparable to those in the control group (Manchanda et al. 2015); i.e., self-selection on observable and unobservable behavioral metrics. To address selection on observables, we run a series of analyses, matching the treatment and control group customers on the basis of transaction details that potentially affect customer responses to the upward line extensions. To this end, we employ several different matching algorithms including propensity score matching (Imbens and Rubin, 2015), nearest neighborhood matching (Abadie and Imbens, 2006), and causal forest (Wager and Athey, 2018). The treatment effects based on the matched sample reveal that the effects of upward line extensions on purchase are substantively invariant to those based on our proposed model. That said, selection on the observable behavioral metrics does not determine the existence of upward line extension effects.

In addition to the selection on observables discussed above, the unobservables not reflected in our data may differ across customers in the treatment and control groups. Although our difference-in-differences approach reduces such individual-level differences by

design, we test selection on unobservables, employing the Heckman selection model (Heckman, 1976). We find the presence of selection on unobservables (the inverse Mills ratios) to be significant across customer purchase measures and even after selection on unobservables is controlled for, the treatment effects still exist.

## **6. Conclusions**

Our findings indicate that launching a complementary product as an upward line extension helps the product line in terms of revenue growth, but a substitute launched as an upward extension is detrimental to overall sales revenue. It appears that once customers like the new premium offering, they increase their frequency of purchase and the complementary nature of the offerings “pulls” the core offering along with the premium offering. In addition, when estimating alternative models that control self-selection, we find that the causal effect of upward line extensions on the firm's revenue is substantively invariant.

This study makes several theoretical and managerial contributions. First, it further bolsters the extant literature on upward line extensions by providing an empirical framework which evaluates the causal effect of upward line extensions on a firm's revenue. Second, it illustrates the differential effect of an upward line extension to a substitute product versus that to a complementary product, which gives managerial implications for a firm's positioning strategy for upward line extensions. Finally, it rules out potential self-selection common in field-data based studies by replicating a randomized experiment.

Although this study provides valuable insights for the literature on product line extensions, it possesses some limitations. First, the estimated model does not include supply availability and competition, both of which can potentially influence the firm's pricing and decisions related to product line length. Presence of these data can develop boundary conditions that allow us to identify the firm's feasible line extensions from existing products. Second, our data span only six months and this restriction prohibits us from investigating alternative sources of the causal effect, for example, its ability to “win-back” infrequent customers. Future research studies can be designed with the aforementioned limitations in mind in order to further enhance the literature related to product line extensions.

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