# Online Availability


**Daniel Corsten and Thomas Gruen**

**Abstract** This chapter presents a research study of online availability (OLA) in six non-food consumer goods categories (baby care, fabric care, hair care, oral care, skin care, and shave care) at online and omnichannel retailers in six major countries (China, France, Germany, Japan, UK, and USA). It provides insight into the extent of online availability (OLA) and its opposite non-online availability (NOLA) using data from online retailers' websites, reports from surveys of online shoppers, and surveys from managers of online retail and branded goods manufacturers. It illuminates online shoppers' encounters with NOLA and reactions to it with a detailed examination of switching behavior to alternative options. It estimates the lost sales opportunities and provides guidelines for improving OLA.

**Keywords** Availability · Omnichannel · Online retail · Stock-outs · Out-of-stocks · Shopper switching behavior

## 1 Background

Product availability is the precondition for selling brands at online and off-line retail. No wonder that over the past decades, industry and trade associations have sponsored and/or released major reports on out-of-stocks. This constant attention points to one thing: product availability continues to present major challenges in retail, both traditional brick and mortar as well as online.

In 2002, we published a landmark study on retail out-of-stocks covering 52 separate studies, 29 countries, 32 categories, and 72,000 shoppers (see Gruen et al. 2002). It presented the largest single compilation of findings on the extent,

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causes, and consumer responses to retail out-of-stock situations in the fast-moving consumer goods industry at that time. We found the level of out-of-stocks to be at 8.3% and that 72% of the responsibility for stock-outs was at the store level. We also found that—when confronted with an out-of-stock—26% of shoppers switch brands, 31% switch stores, 19% substitute within the same brand, 15% delay their purchase, and 9% do not purchase at all. In 2007, we published a follow-up study that described essential measures to reduce the level of stock-outs (see Gruen and Corsten 2007). The results of these two previous studies present the benchmark with which we will compare the results of this new study about product availability at online retail.[1]

Since the release of our second study in 2007, retail has undergone dramatic change, with the focus now on omnichannel shopping (Bell et al. 2014). Recent industry figures show that across major retail categories, 30% of all shoppers regularly shop online and in stores. This number is slightly higher for beauty and personal care (32%) and somewhat lower for household care (16%). The study also shows that penetration of omnichannel shopping is around the average of 30% for four of the countries featured in this study, namely the USA, Germany, France, and Japan, and already substantially higher (48% and 56%, respectively) for the UK and China (for full details, see GfK Future Buy 2016).

Product availability in fast-moving consumer goods retail as well as the causes and effects of out-of-stock items has been a regular topic of interest to academic researchers, retailers, and brand managers. Research on product availability and out-of-stocks started with important industry studies (e.g., Coca Cola Research Council 1996; Gruen et al. 2002). It inspired research on demand estimation when stock-outs truncated demand and caused lost sales. The seminal study by Anupindi et al. (1998) extended the research into stock-out based substitution. This spawned a flurry of related work (examples include Kök and Fisher 2007; Honhon et al. 2010; Jain et al. 2015; Lee et al. 2016; Musalem et al. 2010; and Vulcano et al. 2012).

The last few years have seen research investigating specific issues in omnichannel systems. It builds on the notion that inventory information is readily accessible online and can induce learning from availability information (Cui et al. 2019), can facilitate switching between online and off-line channels (Gallino and Moreno 2014), and can improve pricing decisions (Fisher et al. 2018). Our research on the extent of online availability (including aspects of off-line availability) as shoppers perceive it and their reactions to non-availability falls into this emerging research stream.

Shopper behavior in the face of out-of-stock items in fast-moving consumer goods categories in retail shopping has been heavily researched (e.g., see Campo et al. 2000, 2003; Emmelhainz et al. 1991; Fitzsimons 2000; Gruen et al. 2002; Gruen and Corsten 2007; Sloot et al. 2005; Verhoef and Sloot 2006). However, shopper behavior in situations of unavailability in online shopping has received

[1] See Corsten and Gruen (2018) for full details of the study presented in this chapter. Permissions for use in this work were provided by the authors and publisher.

limited research and is less well understood (for exceptions, see Breugelmans et al. 2006; Huang and Zhang 2015; Jing and Lewis 2011). This chapter includes our examination of switching behavior when consumers encounter non-availability of the consumer goods they intended to purchase when shopping online. When shoppers encounter non-availability of an item they desire (such as it being out-of-stock or back-ordered), online shopping differs from traditional retail shopping in that the interface is not with the actual item but with a visual representation of the item. The cost to search other online stores for the exact item is low, while search within the category can be more difficult due to limited ability to view the entire "shelf" for alternatives, particularly when using a mobile device.

## 2 Overall Study Methodology

We developed and employed a five-stage process for this research study, beginning with an assessment of the OLA environment of retailers and their suppliers of fast-moving consumer goods. With that understanding, we addressed each of the remaining stages. Detailed descriptions and findings follow in the remainder of the chapter. Figure 1 depicts the five-stages of the study.

## 3 Measure Online Availability Extent

This section presents the findings from a 9-month examination of retailers' product pages.

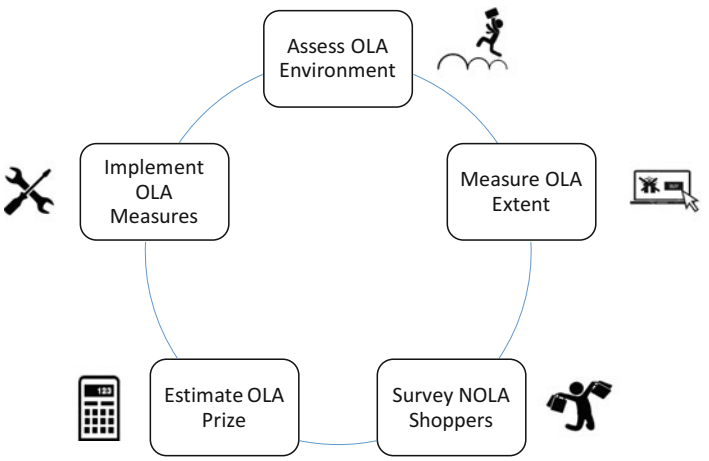


**Fig. 1** Stages of the study

### 3.1 Data Sample

We obtained data from an online retail analytics company that harvests availability information daily from online retailer websites, and we examined six categories across six countries. We collected data on availability in selected non-food categories including care products for Skin, Baby, Oral, Hair, Fabrics, and Shave in the USA, UK, Germany, France, Japan, and China. We report averages across the brands of five major suppliers in each category.

### 3.2 Definition of Online Availability (OLA)

We introduce a new shopper-centric definition of online availability (OLA). An item is OLA for the shopper if it can be purchased online, i.e., the product is displayed as (1) *in-stock* by the brand owner, or (2) can be bought at the retailer's *marketplace* (if the retailer maintains this option). This pertains to retailers that buy and sell inventory through their own stores, and also maintain a marketplace where they earn a fee for completed transactions. (3) We also consider a product available if the product page displays an *in-store only* message, i.e., the shopper is informed that the product can be purchased in selected physical stores of the same retailer. It is important to clarify that this is not the same as "click and collect" where the shopper purchases the product online for in-store pickup. In this case, the shopper cannot purchase the item online, but it is available at the retail store for purchase.

### 3.3 Definition of Non-Online Availability (NOLA)

On the other hand, an item is *NOLA* if it is (1) *out-of-stock* (OOS), i.e., the product page is accessible for the shopper, but the online retailer indicates that the item is physically *unavailable* for purchase. An item can also be (2) *void*, i.e., the product page is digitally *inaccessible* because the retailer has taken it down for commercial or technical reasons. An item can only have one status, but a retailer has some discretion in what status to assign. Some online retailers will void a product page when an item is OOS, and the retailer has the policy not to show its stocked-out products to its shoppers. Retailers may also void a product page if there are errors on the page (e.g., picture, description, price, or product code are incorrect or not uploaded) even when they have the product in stock. They may also void a product page when they cannot match competitors' pricing on the item, even though they have the item in stock (this is commonly referred to as a "can't realize a profit" situation, appropriately used with the acronym CRAP). Irrespective of the reasons, a voided product is NOLA to a shopper.

## 3.4 Data Collection

We extracted availability data at the category level for 273 days from January 1, 2016, to September 30, 2016. We collected for each retailer, category and country combination the daily product count for in-stock, marketplace, in-store only, out-of-stock, or void if applicable. Within each retailer's category, we collected data of the SKUs of up to five typically pre-selected large suppliers. An example data entry reads:

> Date: January 1, 2016; Country: China; Category: Baby; Retailer: Amazon; in-stock: 150 items.

We then aggregated the count data to different benchmarks (e.g., retailer/country/category combinations). Since we use the raw count data and not percentages, we weight the results by the number of SKUs in each country and category. In total, we analyzed more than 12,000,000 data records in what to our knowledge is the largest database on product availability. We exclude the fourth quarter of 2016 when major events lead to seasonal sales spikes and a corresponding risk of NOLA.

## 3.5 Worldwide Extent

The overall extent of OLA across all countries, categories, and retailers is 80.1% and correspondingly, the extent of NOLA is 19.9%. OLA can be further divided into *in-stock* (74.0%), *in-store only* (0.7%), and *marketplace* (5.4%). NOLA can be split into 8.1% *out-of-stock* and 11.8% *void*. The 8.1% out-of-stock is surprisingly similar to the global stock-out rate of 8.3% established in our 2002 study for shelf out-of-stocks in physical retail stores. The results are conservative as our data excludes smaller suppliers and the important seasonal demand spikes in the fourth quarter.

## 3.6 Extent by Country

The results vary by country. Three countries stand out. Japan has overall the highest OLA (87%). In China, OLA is lowest with 68% because of a high stock-out rate (19%) and void rate (12%). France has an average OLA of 82% with the lowest out-of-stock rate (1%) and the highest rate of voids (17%). For the USA, UK, and Germany, stock-out (4–5%) and void ranges (9–12%) are similar.

We speculate that the results vary primarily due to country factors but also due to retailer-specific shopper notification policies in case of lack of availability. We find, for instance, that retailers in France and the UK tend to void product pages rather

than indicating its unavailability on the product page. We believe that these retailers would prefer to avoid time-wasting searches for products that are not available and to avoid potential reputational damage if they would signal stock-outs (Figs. 2 and 3).

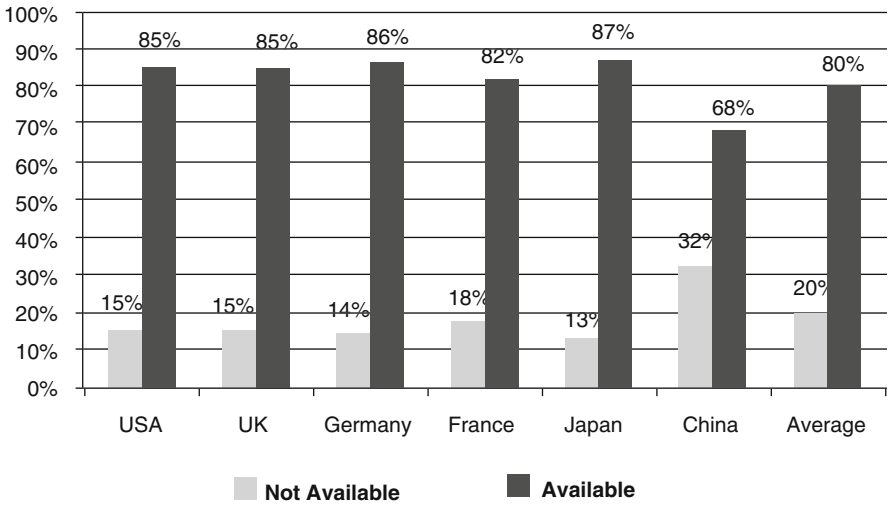


**Fig. 2** Availability extent (OLA and NOLA) by country

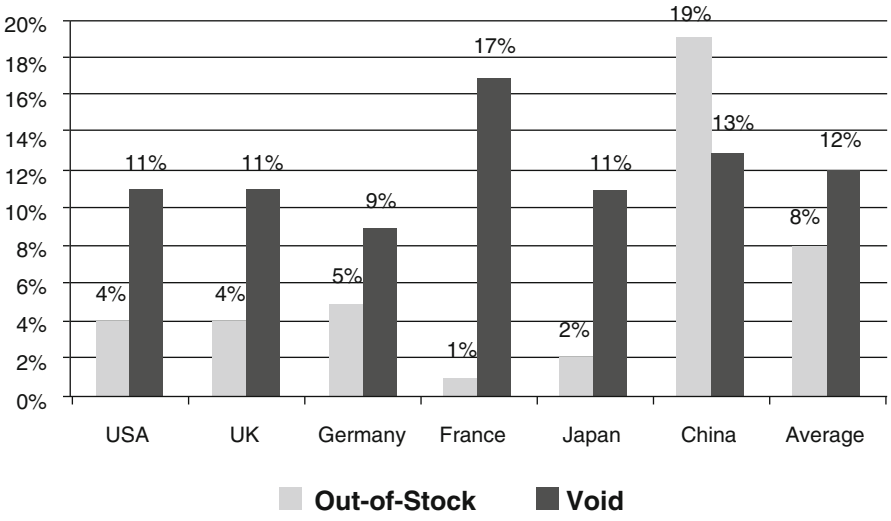


**Fig. 3** How out-of-stocks and voids vary by country

### 3.7 Extent by Category and by Online Retailer

OLA varies across categories between 72% (skin care) and 80% (shave). Across all countries, the hair category has the highest (10%) and the shave category the lowest stock-out rate (5%). Voids are highest for fabric care (15%) and lowest for shave (10%). Comparing OLA by category and country, overall there is less variability among categories than among countries.

There are substantial differences of OLA across channels where pure online retailers have higher availability than omnichannel retailers. This is in line with inventory theory because omnichannel retailers that pick online orders in stores will have more demand variability, and their store inventory has to serve both online and off-line demand (Anderson et al. 2006; Gallino and Moreno 2014). Pure online retailers only serve online demand and can benefit from inventory pooling since they pick from warehouses that serve larger regions.

## 4 Survey NOLA Shoppers: Extent

### 4.1 Methodology

As part of the overall research project, we conducted two studies of shoppers to understand how shoppers encounter NOLA and how they respond when they discover that the item they desire is unavailable. One of the studies, surveying US online shoppers, also provided a measurement of the extent of OLA. For this study, we collected data between June 27 and September 7, 2016, from a panel of online shoppers. When a panelist would record an online purchase in any one of the six target product categories, they received an invitation to take a survey on their mobile device. Of 9336 contacts, 8185 qualified for the survey by verifying their online purchase of an item in one of our categories of interest. Once qualified, each panelist was asked if the item they purchased was the item they wanted to buy, and also asked whether the intended item was available at the site where they originally wanted to purchase the item. From the 8185 qualified respondents, the overall extent of NOLA was 16% (1308), while 84% (6877) found exactly what they wanted.

### 4.2 Factors Affecting NOLA Extent

The analysis showed several factors affecting NOLA. There were category effects for baby care (18%) and shave (11%), while the other categories did not vary significantly from the 16% overall average. There was an effect of race/ethnicity, with white shoppers encountering NOLA <14% of the time, while non-white averaged above 20%. Age and income also showed significant effects, with younger

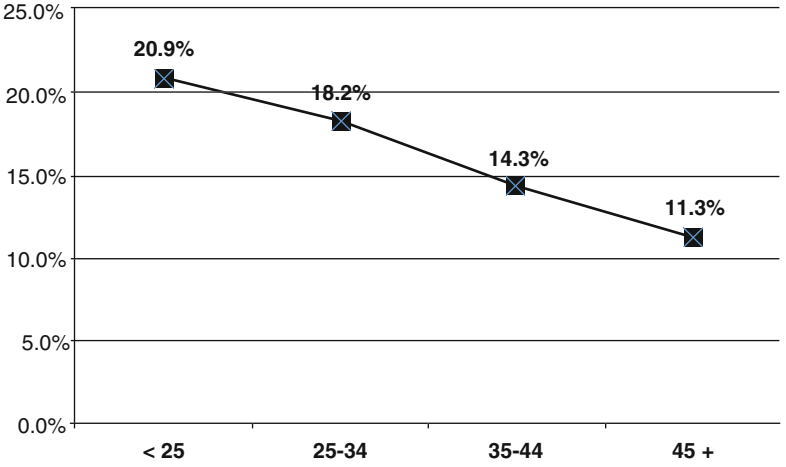


**Fig. 4** NOLA encounters negatively correlated with age

and lower income both encountering higher NOLA than older and higher income (age and income were also highly correlated, so the effects may not be independent). Figure 4 illustrates the effect of age on NOLA encounters. There was no substantial difference between male and female encounters of NOLA.

# 5 Shopper Encounters and Reactions to NOLA

## *5.1 Shopper Encounters*

### 5.1.1 Methodology and Definitions

To understand shoppers' reactions when encountering NOLA, in addition to the US shopper study, we also conducted a second study that surveyed shoppers in China, France, Germany, Japan, and the UK.

We collected data between September 27 and October 10, 2016, with a global market research provider, who contacted (via e-mail) panelists from their quarterly survey. The target sample was 1000 respondents per country, and the final sample had slightly more than 1000 from each country except China, where there were 861 respondents. Overall, there were 5039 qualified responses across five countries. Each of the respondents answered the same questions as those asked in the US shopper survey. The survey was translated into the respective native language of each country.

Of the 5039 respondents, 42.8% (2159) did not find the item available as desired, while 57.2% (2880) found exactly what they wanted. It is important to note that the design of the data collection for this survey was not intended to provide a valid indicator of the overall extent of OLA in those countries.

### 5.1.2 How Shoppers Encounter NOLA

Online, NOLA interrupts customers' shopping journeys in four different ways. First, online retailers present the item specifically to be unavailable or "out of stock." This is similar to a shopper in a retail store finding an empty spot with a shelf-tag but no corresponding product available. Secondly, the retailers inform the shopper that there will be a substantial delay in shipping or pickup, indicating that the item is not immediately available, but will be available in the future (typically 1 week delay or longer). This corresponds to back-ordered items, which indicates that there is an issue somewhere in the supply chain. The third occurs when the shopper cannot find the specific item they want on the web or mobile site. This may occur due to the item not being shown by the online merchant (purposely removed when the item is not available), programming errors, or simply not found due to user error. The fourth is that the item is not available for purchase online and only available to purchase in a retail store that is associated with the online store. Our conceptualization of non-availability covers all four ways the shopper is unable to purchase their desired item online. Regardless of how the shopper encounters the non-availability, the customer experience is altered from their intended and expected experience.

Figure 5 shows that shoppers across all six countries reported that on average 45% of the NOLA encounters were stated "out-of-stock." Twenty-seven percent of shoppers indicated there would be a long shipping delay (back-ordered), 20% of shoppers could not find the item, 5% of shoppers were informed that the item was only available for purchase in the store, and 4% of shoppers did not indicate the reason the item was NOLA. The variation by country is shown in the figure.

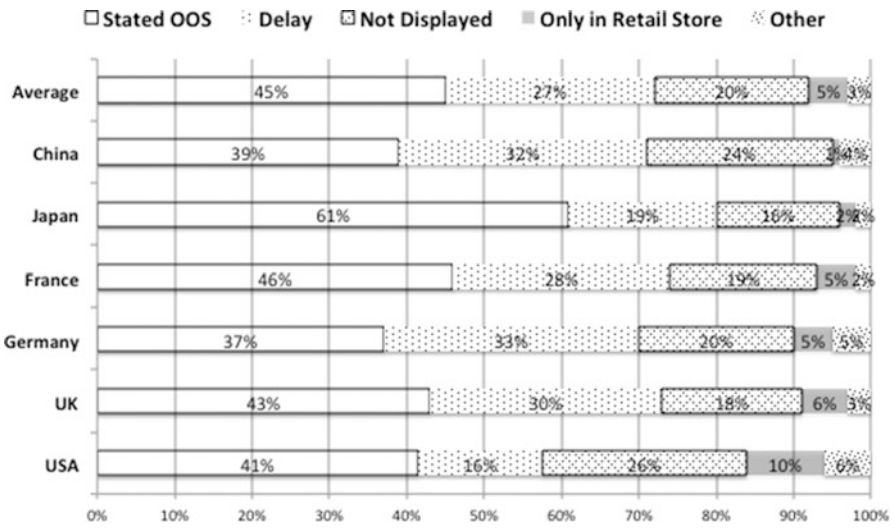


**Fig. 5** Shopper's NOLA encounters by country

### 5.1.3 Comparing Harvested Data and Shopper Study Data

While the methods do not allow us to draw exact comparisons of the extent as harvested from the retailer websites and the extent reported by shoppers, we are able to offer several observations. First, the overall extent of OLA in the USA was 15% (4% OOS and 11% void) in the harvested data, and it was 16% in the shopper study. In 45% of their NOLA incidents, US shoppers encountered items that were stated out-of-stock, and in another 27% items that had a shipping delay. Combined, shoppers reported the item was found but not currently available in 72% of the cases. In only 20% of the cases the item was not found. This suggests that online shoppers may be more cognizant of stated out-of-stocks than items they cannot find.

## *5.2 Shoppers Switching Behaviors when Encountering NOLA*

In the retail store and in online retailing, the customer's shopping journey is interrupted when the shopper encounters the desired item to not be available in the time or place they expect to find the item. The shopper then is forced to alter their intended behavior, either requiring additional search or to change the purchase intention by delaying the purchase (Ge et al. 2009; van Woensel et al. 2007). The shopper must weigh the cost of switching stores (either online store or channel) against the cost of switching brands (Corstjens and Corstjens 1995). Following the evaluation of these costs, the shopper then chooses among the following options: to stay at the same online store and purchase a variant of the desired brand (e.g., size or type) or purchase a different brand, to seek to find the item at a different online retailer, to seek the item in the retail channel, or to delay or cancel the purchase altogether (Campo et al. 2000; Gruen et al. 2002; Sloot et al. 2005).

### 5.2.1 Shopper Response by Country

There are substantial differences among the six countries for shoppers' ultimate purchase behavior responses (Fig. 6). One hypothesis suggests that these differences are due to the online retail structure among the six different nations we studied. For example, in the USA with Amazon holding the major market share, there is less online retailer switching and more switching within the same online store. All three European countries have very high brand switching, which may be due to the presence of strong private brands. Japan has the highest intention switching (delay/cancel), which may indicate strong supply chains that will likely provide the desired item later without further search. China has strong online store competition, so online shoppers can find their item easily at other online stores.

As a further note on the figure, the option to "switch channel" combines the responses from purchasing the item at the retail store of the online retailer and from a different retail store. The option to "switch intention" combines the delay and cancel purchase responses. We combine these two because in the case of "delay" as well as "cancel", shoppers change their intention of purchasing an item to not

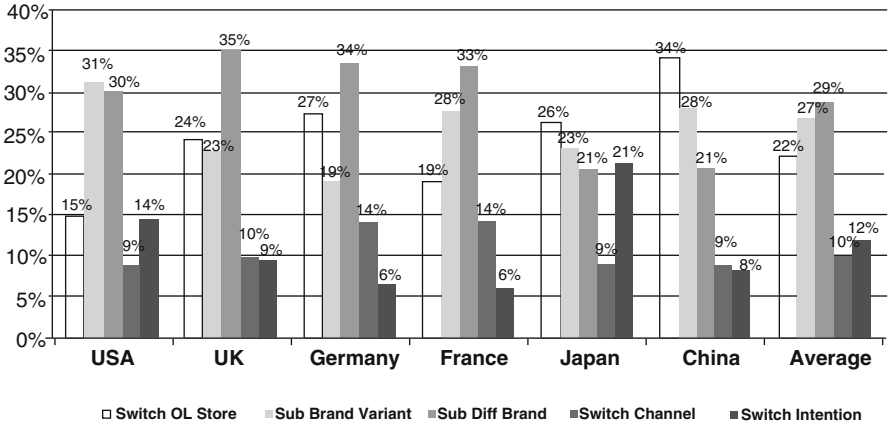


**Fig. 6** Shopper response to NOLA by country

purchasing an item during the online shopping trip; also the individual response category percentages were small.

In the USA, only 15% of the online shoppers switched online stores while more than 60% purchased a substitute item on the same online store. Given the dominance of Amazon (and Amazon Prime) in US online retail, we suspect that shoppers find it more convenient to purchase another brand at Amazon rather than switching to another online retailer. About 8% purchased the item they wanted from a retail store, and 15% either delayed or canceled their purchase (switched intention). Of the 60% who substitute items, half of those switched brands, while half substituted a variation of the brand of the initially desired item. In China, shoppers are more brand loyal than in the USA when they encounter NOLA. About 34% ultimately ended up purchasing the same item from a different online store, indicating that Chinese online shoppers frequently choose from alternative online stores. Only 20% switched brands in the same online store. Shoppers from the three European countries are much more willing to switch brands within the same store—which may be a function of the strength of private brands in these countries. Shoppers from Germany and France are more likely (than average) to switch channels and less likely to delay or cancel. German shoppers are more likely to switch online stores than UK or France. Shoppers in Japan are willing to switch online stores and delay or cancel their purchase (switch intention). They exhibit lower willingness to switch brands, preferring to switch online stores or wait.

## *5.3 Factors Affecting Online Shopper Responses within Countries*

To further examine the differences in shopper responses among countries, we examined several likely factors including category effects, encounter-type effects, basket timing effects, demographic effects, and shopper psychological costs effects.

### 5.3.1 Category Effects

To understand category effects, we compare the switching behavior within individual categories to the overall average. Where significant differences between the category and the overall average occur, we examine that category effect in more detail. US shoppers show distinct differences among product categories (Fig. 7). Laundry and shave demonstrate strong brand loyalty and that a substitute item of the same brand is acceptable. For baby care, shoppers will search other online stores to get the item they want. For skin care, hair care, and oral care, NOLA sends an invitation to try a different brand.

### 5.3.2 Encounter-Type Effects

Here we explore how the manner in which shoppers encounter the item being NOLA affects their switching behaviors. Based on previous research, we would expect that if the item is shown as "out-of-stock," the shopper would be more likely to search within the site to find an alternative. If the item is not found (or void), then the shopper will be more likely to search another store. This would be consistent with Breugelmans et al. (2006) who demonstrated experimentally that visibility and clarity increased their subjects' willingness to purchase in the category. However, we found the switching behavior patterns to be very similar for the item being stated out-of-stock and the item not being displayed. As we would expect, when the item is stated to have a delay in shipping/pickup, we see the highest level of delay (switch intention). As expected, when the shopper is informed the item is only for sale offline in a retail store, we see the largest percentage of channel switching, almost double that when the item stated to be out-of-stock.

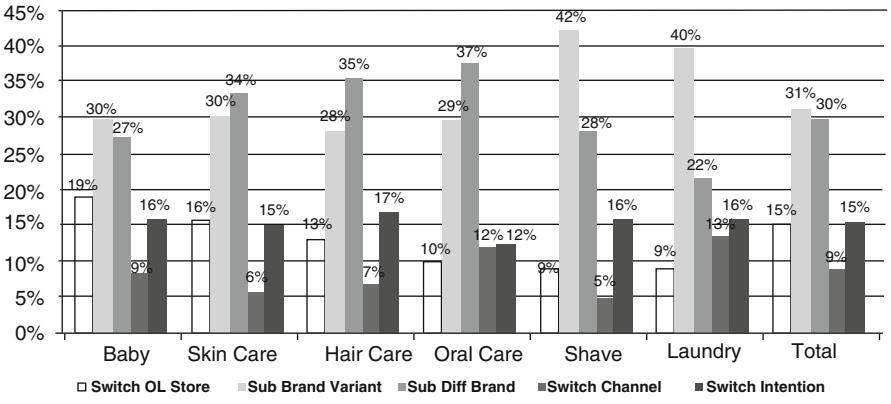


**Fig. 7** Switching Behavior by Category (US only)

### 5.3.3 Basket Timing Effect

We examined how the timing of NOLA during the online shopping trip influences shopper reactions. We hypothesize that with every decision to put an item into their baskets over the course of a trip, shoppers exhaust their mental resources and switching brands or stores requires additional effort when shoppers encounter NOLA. Somewhat counterintuitively, we found that for US shoppers that when the first item encountered is unavailable, the highest level of brand switching occurs (35% vs. 30% average). When it is the last item on the shopping trip, this shows the highest level of store switching (27% vs. 15% average). When it is the only item in the shopping trip, shoppers are more likely to switch channel (13% vs. 9% average) or switch intention (delay/cancel; 23% vs. 15% average). Switching behavior clearly changes depending on the moment when NOLA is encountered during the shopping trip.

### 5.3.4 Demographic Effects

As expected, we found that brand switching decreases with age, with the youngest shoppers the most willing to switch brands. This would be expected as younger shoppers are less likely to have developed strong brand loyalty, particularly in fast-moving consumer goods categories, than would older shoppers who would have longer experience with brands. Older shoppers are noticeably more willing to switch intentions (delay/cancel). Gender differences are very apparent. Men are more willing to switch online stores and are less willing to cancel/delay than are women. Men are more willing to switch brands, and less accepting of a brand variant when confronted with their desired item to be NOLA.

### 5.3.5 Psychological Costs of Switching

The switching patterns among categories can be explained in part by three shopper costs (transaction, substitution, and opportunity costs), originally identified by Campo et al. (2000), and further explained in our previous study (2002). The first cost is the *opportunity cost* of not being able to consume the product immediately, the second is the *substitution cost* of decreased use of a less-preferred alternative, and the third is the *transaction cost* of the time and effort required to obtain the preferred item. When encountering a NOLA item, shoppers incur these costs, and will seek to minimize the total of these costs. To present a generalized approach, Table 1 shows how the levels of each of the three cost components interact to explain a shopper's expected response to an OOS situation (Gruen et al. 2002; Ehrenthal et al. 2014).

We expect substitution costs and transactions costs to operate as opposing forces, with increasing transactions costs leading to more substitution, and with increasing substitution costs leading to store and channel switching. While we found variations

**Table 1** Shopper costs and switching behavior

| When the opportunity cost is... | And the substitution cost is... | And the transaction cost is... | Then the shopper will... |
|---|---|---|---|
| High | High | Low | Purchase item at another store or channel |
| Low | High | Low | Delay purchase |
| High | High | High | Substitute—brand variant |
| High | Low | High | Substitute—different brand |
| Low | High | High | Cancel purchase |

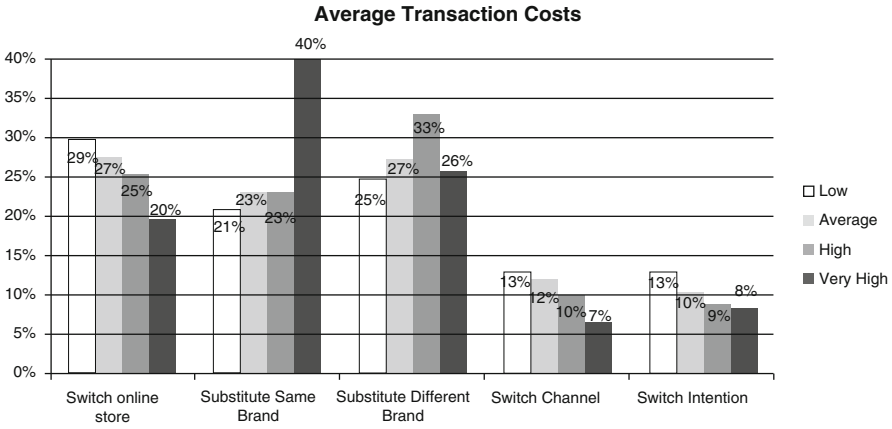


**Fig. 8** Effects of transaction costs on shopper behavior

within each country, when we averaged all countries together, the patterns were very clear, showing the powerful effects of substitution costs and transaction costs. The following two figures illustrate the effects (Figs. 8 and 9).

## 6 Implications of NOLA for Online Retailers and Brands

In this section, we discuss the various financial implications of OLA and NOLA. We propose ways to estimate the lost sales opportunities and present the overall "size of the prize" for the industry in improving OLA. Each of the switching options has a different effect on the sales and profitability of the manufacturer and the retailer. While there are other institutions in the supply chain that are affected by non-availability and shopper switching behavior, we focus on the two central entities, the brand (manufacturer) and the online retailer.

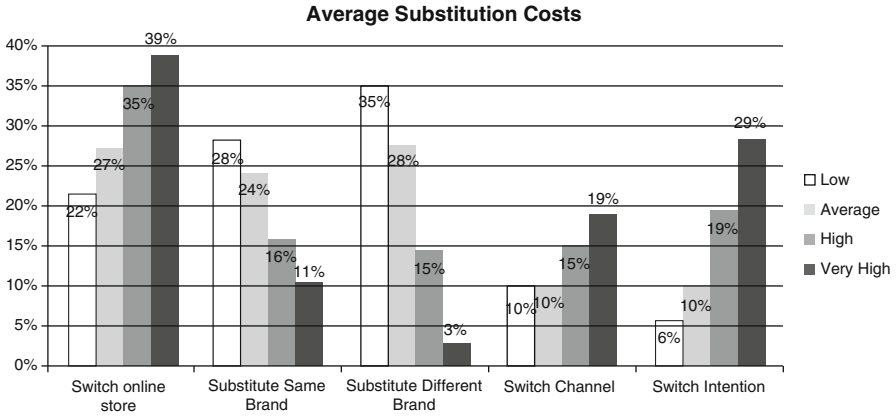


**Fig. 9** Effects of substitution costs on shopper behavior

## *6.1 Types of Losses Due to NOLA*

Our research has identified multiple adverse consequences of low OLA. These are listed below and described in more detail in Sect. 7.2.

- Direct lost sales
- Substitution effects
- Basket abandonment
- Search rank impact
- Buy box losses

## *6.2 Retailer and Brand Loss*

Using similar methodology from previous studies (e.g., Campo et al. 2000; Gruen et al. 2002; Sloot et al. 2005), we apply the information about shopper reactions to NOLA extent to allocate the loss for brands and retailers as follows:

- *Retailer Loss*: Retailers lose if shoppers—when confronted with a NOLA item (a) switch to a different online store, (b) switch to a different off-line store, or (c) cancel their purchase.
- *Brand Loss*: Brands lose if shoppers (a) switch brands or (b) cancel their purchase.
- *Neutral:* Neither retailers nor brands lose if (a) shoppers stay with the online retailer and switch items within the brand, (b) purchase the same item at the retailer's off-line store, or (c) delay their purchase.

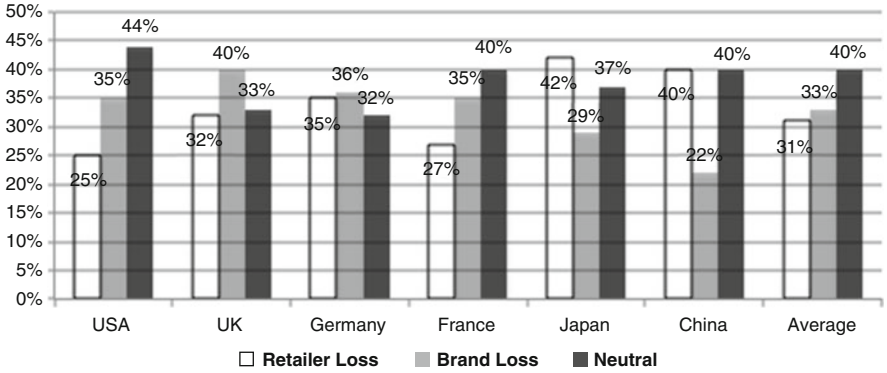


**Fig. 10** Retailer and brand loss varies by country

We find that retailers and brands lose almost equally from NOLA. Across the six countries and six categories, the retailer loss is 31%, whereas the brand loss is 33%. Neutral reactions amount to 39%. Note that the sum of the three aggregate measures is more than 100% as canceled purchases count for both retailers and brands.

Retailer and brand loss differs across countries (Fig. 10). Retailer loss is substantially above the 31% worldwide average in China (40%) and Japan (42%), while it is substantially lower in the USA (25%). In contrast, compared to the 33% world average, brand loss is significantly higher in the UK (40%) and substantially lower in China (22%). Germany (36%), France (35%), and USA (35%) share similar levels of brand losses. Interestingly, the US also has the highest percentage of neutral reactions (44%) because shoppers either switch within the brand or delay their purchase.

A comparison shows much smaller differences in retail and brands loss across categories than across countries. All category results are within 2% of average with the exception of retailer loss for fabric care (3.2% lower) and brand loss for shave (2.8% higher). We tentatively conclude that differences in OLA online are due to differences between retailers and countries rather than due to differences between brands and categories.

## *6.3 Days Lost Online (DLO)*

### 6.3.1 A New KPI for the Industry

Our research allows us to estimate the potential sales opportunity of OLA. We developed a new metric, *Days Lost Online* (DLO), as a simple, flexible, and diagnostic way to determine the Online Lost Sales (OLS) opportunity for multiple levels of analysis: a single SKU, a collection of SKUs, a manufacturer, a retailer,

and the overall industry. We present formulas that can be used to estimate the OLS opportunity on the item level, the firm level, and the industry level.

Our measures of OLA and NOLA count the days that a product is either available online or not available online. We present the measure of days lost online (DLO) as a key performance indicator (KPI) to measure the financial losses of NOLA, and we recommend its use as an industry-wide KPI.

DLO = Number of days that an SKU is not available online at a retailer's online shop

An SKU is available online (OLA) when it is (a) in-stock, (b) available at a store of the retailers, or (c) available at the retailer's marketplace. An SKU is not available online (NOLA) if it is (a) stocked-out or (b) void.

### 6.3.2 Using DLO to Estimate Lost Sales

The online lost sales (OLS) at the SKU level only considers the sales lost on that specific SKU. At the brand level, firms can recoup some of that loss through item substitution. Using our measure of DLO, we can approximate the maximum online lost sales (OLS) per SKU using the following formula:

*Example SKU*: OLS = DLO × DSA × PRICE
DLO = days lost online (days)
DSA = daily sales average (units)
PRICE = Price (local currency)

For the following example calculations, we take the global average for OLA of 80% and for NOLA of 20% (365 days × 0.2 = 73 DLO) and assume that the SKU sells 100 units on average per day with a price of $5 per unit retail and $3 wholesale.

Brand OLS (wholesale value): 73 days × 100 units/day × $3 = 21,900
Retailer OLS (retail value): 73 days × 100 units/day × $5 = 36,500

Using this same approach, we can estimate the size of the prize for a consumer goods manufacturer or omnichannel retailer that sells in the non-food categories that this report features, using an example of $1 billion sales. Following a recent study of the extent of online retail sales of consumer goods (IRI 2017), we use a share of online sales of 5% ($50 million per $1 billion total sales). We use the average NOLA of approximately 20%, which means it took the retailer only 292 days (i.e., 365–73 days) to achieve the online sales of $50 million. Following this logic (and assuming that sales are not seasonal), then these firms could have achieved up to 20% or ten million dollar more online sales or if their product pages had been up and their products had been stocked at retail up to 100% of the time. Note that this calculation shows the absolute maximum loss since it ignores substitution effects and assumes that 100% OLA is possible. We advise to use a lower target OLA for business planning.

*Example Manufacturer and Retailer*: OLS = $1 billion sales × 5% online × 20% NOLA = up to ten million dollar of online lost sales.

### 6.3.3 Estimation for the Consumer Goods Industry and Retail

To extrapolate to the industry level, in 2016, the Global Top 100 publicly listed consumer goods manufacturers had sales of close to $1.7 trillion at wholesale value.[2] Estimating that 5% of sales is online, and NOLA is 20%, then online sales are $85 billion industry-wide, and the online lost sales (OLS) opportunity is $17 billion.

*Example Industry at Wholesale*: OLS = $1.7 trillion sales × 5% online × 20% NOLA = $17 billion online lost sales at *wholesale* value.

We use an estimated retail mark-up of 30% on the suppliers' wholesale price for our non-food categories and estimate the retail sales value at $2.2 trillion. As before, we assume that 5% of sales is online, and NOLA is 20% which leads to an additional OLS opportunity of $5 billion. Overall, the size of the prize of improving OLA is around $22 billion at retail value. Our estimate is conservative as it ignores smaller consumer goods firms that are not in the Top 100 publicly listed firms. On the other hand, we do not account for substitution effects and it is unlikely that 100% of OLA is achievable.

*Example Industry at Retail*: OLS = ($1.7 trillion sales + 30% retail mark-up) × 5% online × 20% NOLA = $22 billion online lost sales at *retail value.*

If we use industry forecasts that the share of online sales of consumer products will increase from 5.0% in 2020 to 10.0% in 2022 (IRI 2017), then the potential losses for manufacturers and retailers are to double over the next few years unless corrective actions are taken.

## 7 Addressing NOLA and Measuring Capabilities

Our study on extent used data automatically collected from retailer websites. While the findings suggest causes, this method does not allow us to directly identify the detailed causes of NOLA. Therefore, building on a series of interviews and workshops with leading retailers and suppliers, we developed the OLA Scorecard on capabilities, causes, and countermeasures.

We validated the tool in two workshops with the ECR Europe Shrink and On-Shelf Availability Group in February 2018. The ECR Europe Shrink and On-Shelf Availability Group counts more than 50 retailers, suppliers, service providers, and academics of which 20 retailers and 9 suppliers answered our survey. The OLA Scorecard covers five general areas, each explained below:

[2] https://consumergoods.com/cgts-top-100-consumer-goods-companies-2016.

## 7.1 Measurement and Extent

Overall, the problem of OLA is multi-faceted and not well understood, neither by retailers nor by suppliers. Surprisingly, even global consumer goods firms treat OLA with a low level of priority, interest, and even awareness. When questioned about their extent of OLA, most brands had only a vague, often erroneous, notion of the extent to which their products were unavailable. The OLA extent brands recalled generally ignored the fact that voids represent an additional class of NOLA from the shopper's perspective. When we confronted retailers and suppliers with the extent figures from our study, the response was typically surprise and disbelief. Few brands track the daily changes of availability regularly or proactively, even those that subscribe to retail analytics services that provide daily measures. Many times, brands reviewed the data only weekly or bi-weekly. We found very few brands that proactively managed OLA using alerting features for low availability. We also saw brands in which marketing and salespeople had access to OLA data from service providers but supply chain colleagues did not.

## 7.2 Consequences of NOLA

In our interviews, we identified multiple short- and long-term consequences due to lack of OLA. Of interest, none of our interview partners was aware of all the negative effects of low OLA.

### 7.2.1 Lost Sales

Our survey shows that in contrast to suppliers, retailers regularly assess the cost of lost sales due to lack of online availability.

### 7.2.2 Substitution Effects

Our shopper survey shows that brands and retailers lose equally when shoppers encounter missing products. Our interviews have shown that retailers and suppliers lack the data on how shoppers react to missing products and inaccessible product pages. Instead, they often assume wrongly that online reactions were no different from off-line. Often overlooked are the indirect effects of stock-outs. Sales figures for products that are available show the true demand for those items, but when products are not available, the true demand for those items is unknown. Demand for stocked-out products could have been equal or more than what sales figures suggest. Worse, if consumers switch to another product, the demand for the other product is inflated as it benefits from the stock-out of the original product. Our

research supports that stock-out based substitution distorts the true demand for a product. As an additional consideration, online retailers often replace NOLA items with a higher priced substitute product, absorbing considerable additional cost when fulfilling customer orders.

### 7.2.3 Basket Abandonment

When a shopper decides to switch stores to substitute an item, she can replace only the missing item or she can abandon the whole basket that she intended to purchase online. This phenomenon is known as "shopping cart abandonment" and is a major concern for retailers. While industry studies typically show very high numbers of shopping cart abandonment, a high percentage of this is because shoppers often open a basket for browsing without ever intending to purchase items. Somewhat counterintuitively, our shopper research shows that when a shopper encounters a non-available item early on in the shopping trip, she is likely to substitute a similar item, but when she encounters a non-available item later in the shopping trip, she is more likely to switch stores. This exploratory result warrants further research.

### 7.2.4 Search Rank Impact

Although online retailers such as Amazon and Walmart do not publish the details of the algorithms of their search engines, one major factor in their ranking of search results for product pages is product availability. Therefore, low OLA reduces search ranks, which in turn reduces page views and eventually sales.

### 7.2.5 Buy Box Losses

This cost of NOLA occurs when retailers (such as Amazon and Walmart) have marketplace options to fulfill online orders for the same SKU. Amazon usually awards the top-spot on a product page to the brand owner. However, when a product is not available, the brand owner can lose the "buy box" to a marketplace reseller that offers the same SKU. Although this loss might still result in the sales of the original SKU (by a different seller), losing the "buy box" is not desirable to the retailer who has to trade off the loss of a higher retail margin in exchange for inventory risk with a lower commission. For the supplier, a lost buy box means losing control over the sale, channel, and the risk of poor service quality. It is also worth noting that the shopper may also bear a cost due to increased shipping from multiple sources.

## 7.3 Causes Out-of-Stocks and Voids

Broadly speaking, we find that demand management and product supply issues cause low OLA. Our survey suggests that suppliers find it much harder to estimate online demand for established products and special promotions. Suppliers prioritize off-line channels over online channels and have trouble determining how much inventory they need to serve both online and off-line shoppers from the store. On product supply, suppliers struggle to fulfill orders quickly enough to ensure online availability.

On the other hand, data errors surrounding product transitions and master data issues lead to more voids. In general, the more product transitions retailers or suppliers manage, the more likely they are to experience data inconsistency, and consequently, retailers will either delay publishing a product page or void it. Another source of voids is infrequent or incomplete synchronization of product listings. Retailers and suppliers should regularly prune product pages and agree which ones to keep or delete. When retailers stop selling products, their pages should be shut down (unless there are post-sales obligations such as warranties). However, many times they continue to be operational but inaccessible to shoppers. These "phantom pages" inflate the count of void product pages.

Retailers also void product pages for commercial reasons sometimes without informing their trading partners. Many retailers prefer to void a product page rather than show the product as out-of-stock. This "misnomer" is not only inflating the number of voids (e.g., as we see in France) but also irritating to shoppers that may now assume that the retailer no longer carries the product. Finally, one brand reported that a major online retailer had voided up to 20 items per month without informing the supplier because the items had become unprofitable.

## 7.4 Strategy and Countermeasures

Unless it is a strategic priority, we cannot expect retailers and suppliers to work together to achieve a high OLA. Both groups agree that OLA is a high priority, with the retailers giving it more importance than suppliers do. Both retailers and suppliers have similar opportunities when achieving higher OLA, thus each should have similar levels of motivation.

However, most importantly, few suppliers have appointed a dedicated manager for OLA. At most brands, the job of OLA is with a customer logistics manager who often is also responsible for deliveries to the retail warehouses and/or on-shelf availability. Even among the brands with a responsible OLA manager, the person usually resides within the physical supply chain and has no or little influence on the digital side of voids. Our results suggest that retailers already have better capabilities to improve OLA than suppliers do. The latter seem to have neither a systematic process for collaboratively managing OLA internally across functions nor externally

with their trading partners. External discussions about OLA with trading partners are somewhat more common, although differences in measurement and perceived importance can lead to conflicts. Finally, suppliers trail retailers in the systematic way they have identified root causes of low OLA and the countermeasures to alleviate it.

A final observation concerns the responsiveness to OLA data. Many brands still decide and execute at a clock speed of weeks rather than days or hours. We found that many brands do not use the daily OLA data to react proactively at the same speed. Unlike syndicated historical market data used in traditional retail, online retail data is instantaneous and allows instantaneous reactions. Brands will need to accelerate their processes to match the speed of online retailers and the expectations of modern shoppers. On the other hand, retailers should start collaborating seriously with suppliers to develop robust and fast processes that guarantee high OLA.

## 8 Conclusion

The results of this study show that OLA and its opposite NOLA present substantial challenges to retailers and their suppliers of fast-moving consumer goods. The extent of NOLA as measured on online retail websites is surprisingly large, and this extent is exacerbated by the presence of voids. Shopper studies show reactions to NOLA include substantial switching to another online retailer or substituting items and brands at the same online store. Variations in levels of OLA are more due to differences between retailers and countries and less due to differences between categories and brands. The similar levels of retailer and brand loss show that brands and retailers will benefit mutually from improved OLA. We present a new method to calculate online lost sales (OLS) using the measure of days lost online (DLO), which can be used to examine any unit of analysis.

Our industry survey of causes, countermeasures, and capabilities of OLA across food and non-food manufacturers and retailers shows that industry has to improve its readiness significantly if it wants to compete in this growing segment of the business.

The findings of this study provide more than adequate evidence to encourage retailers and brands to collaborate and enhance online availability in the fast-growing area of online retail.

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