"Hurry! Only 3 left in stock!"
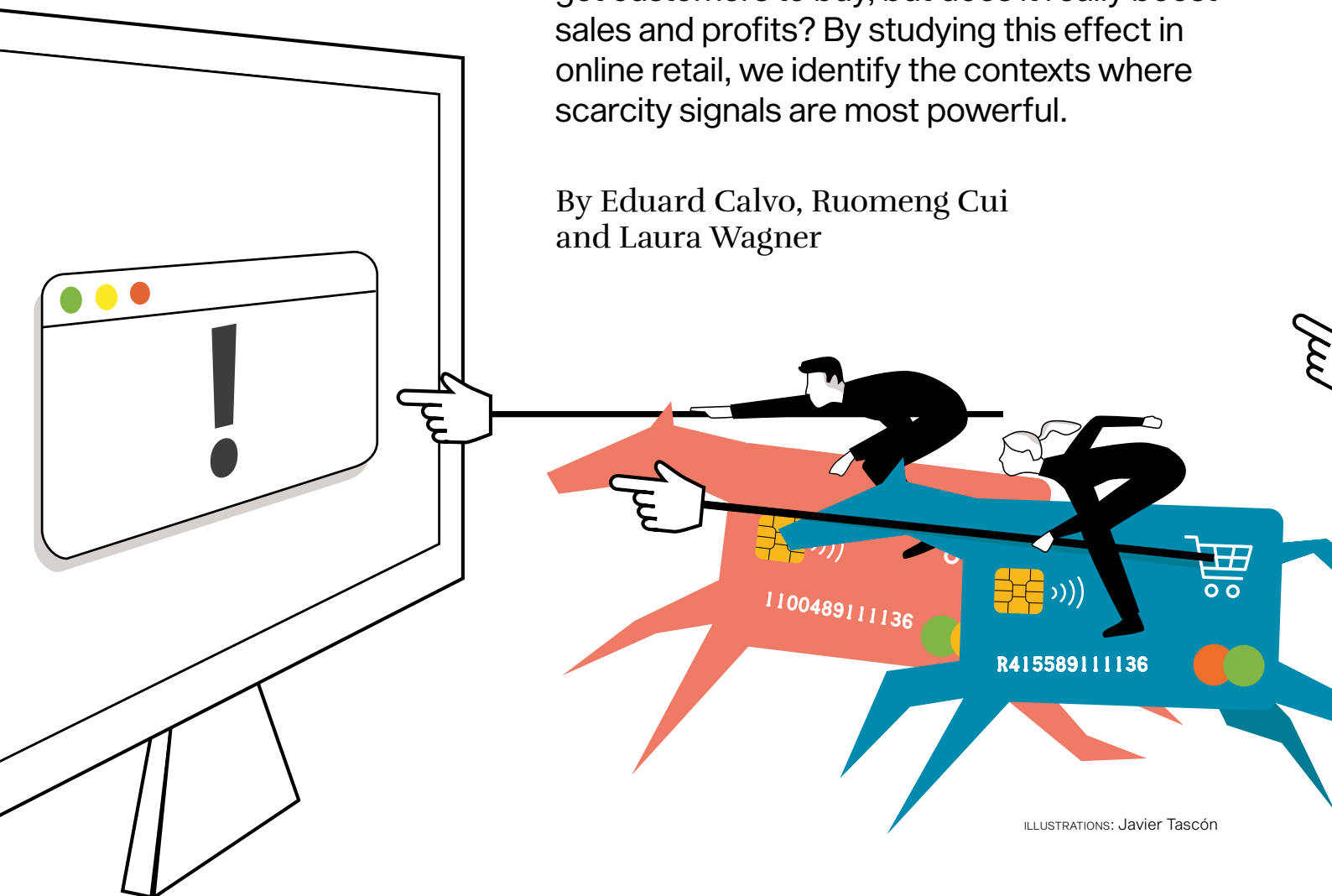
Many retailers disclose product availability to get customers to buy, but does it really boost sales and profits? By studying this effect in online retail, we identify the contexts where scarcity signals are most powerful.

By Eduard Calvo, Ruomeng Cui and Laura Wagner

ILLUSTRATIONS: Javier Tascón

How many times have you gone online to book a flight and a message pops up to say, "Hurry! Only 3 seats left!" Or you're browsing hotels and you're alerted that "only 2 rooms remain for your dates" and that "10 other people are looking at this hotel" which was "booked 2 times in the last hour." The sales channel may have changed, but the tactic is the same: pressure selling, designed to make consumers rush into a purchase.

The use of scarcity signals, like those just described, varies among online retailers. Amazon, for instance, discloses the availability of "lightning deals," or limited-time offers, in real time and for the entire deal duration. Others, such as Veepee, never disclose product availability other than when it sells out. With no apparent industry consensus, we set out to discover to what extent scarcity signals served to drive sales and profitability in online retail, and in what context providing such information was more effective.

To reveal or not to reveal?

Why would a retailer consider revealing inventory information in the first place? Telling consumers when availability is low has two effects: 1) *the scarcity effect* induces some customers to buy while they can for fear of missing out; and 2) seeing customers rushing to buy prompts others to follow suit, in what's known as *the herding effect.* Product popularity is taken as a proxy for product value. Harnessing these effects can boost sales.

However, it can also backfire. Customers driven by scarcity pressure may spend less time shopping around and make an impulse purchase less aligned with their needs. And customers following the herd may buy a product that doesn't live up to their expectations. In both cases, customers may be left feeling disappointed and ask for a refund or return, which can be costly for a business, especially if any moderate sales gained through pressure selling were cancelled out by a massive number of subsequent returns.

How profitable is it, then, for a firm to display this information? To answer this question, we partnered with a global online retailer and analyzed its transaction data. The retailer's business model is "flash sales" – branded products that are heavily discounted and sold until stocks run out. Margins are slim, and increasing sell-out is key for profitability. Our data spanned over 190,000 products, nearly 1,300 brands and around half a million customers.

The disclosure of low product availability was what interested us. This particular retailer didn't disclose product availability until its inventory level had dropped to five or fewer units, at which time it displayed "five units left" and continued to update availability, in real time, until the end of the sales campaign. With this "five or fewer units" policy, we were also able to observe sales patterns of products whose availability was never disclosed. But we had to be careful: the fact that a product sold down to five units implied that it was already a bestseller, and we didn't want to confuse that fact with the disclosure of "five units left" as being the reason for its popularity. So, we twinned like-for-like products, linking products of the same brand, category and price that, just before

hitting five units, had sold a similar number of units. As such, we are confident that the patterns we observed were indeed caused by the revelation of inventory information.

A clear boost

We found that the disclosure of low product availability increased hourly sales – they grew by 13.6%. This stands to reason: Who likes missing out on an exclusive deal?

However, those purchases made under the influence of scarcity signals were far more likely to be returned – product return rates increased by 17%. As mentioned earlier, the disclosure of product availability may pressure customers into impulse buying, only to find that their purchases don't suit their real needs.

Because returns involve additional operational costs, revealing product availability could negatively affect a retailer's profitability. For this, we studied net sales (a product's hourly sales minus hourly returns) and found they still increased – by 12.5% – after the retailer revealed low availability. This means that, even in the context of a return
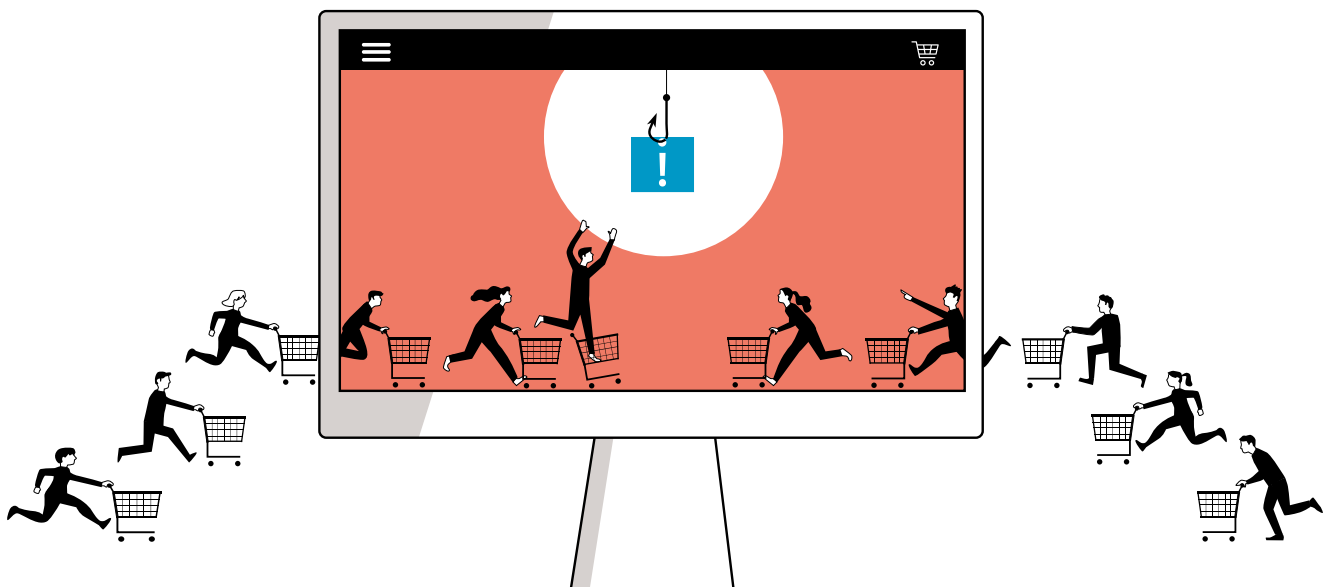
Closer deadlines put extra pressure on customers so as not to miss out on the scarce product
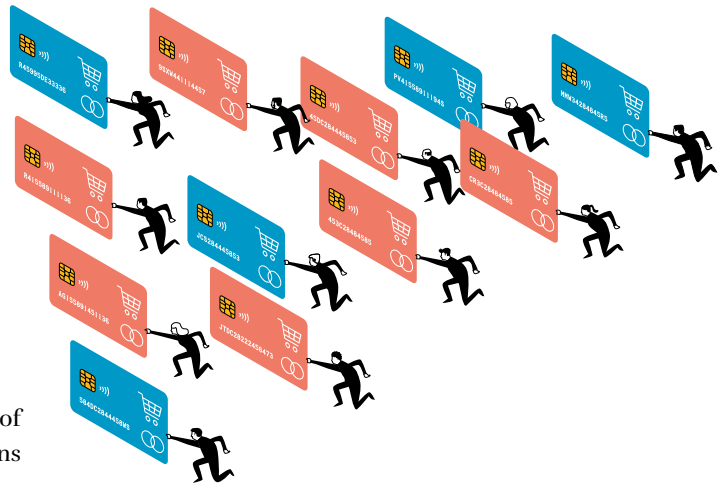
canceling out the entire economic contribution of a sale, the effect of these scarcity signals remains profitable overall.

These results would imply that revealing low product availability to customers is an effective tool for boosting sales and profits in online retail, even accounting for the possibility of returns.

The importance of context

Having said that, the disclosure of scarcity signals is not equally important for all products: some elements accentuate or temper the strength of this technique. In particular, we find that scarcity signals are most powerful when:

THE PRODUCT IS DEEPLY DISCOUNTED. Heavily discounted products not only sell better, but customers are also more sensitive to the disclosure of their limited availability. A deep discount decreases the cost of making a wrong choice; it also increases the value for money of a product. When combined with a low availability signal, this makes it easier for customers to commit to a purchase instead of shopping around for longer.

THE PRODUCT IS ON SALE FOR A SHORT TIME. Campaigns of longer duration mitigate the effect of disclosing product availability because customers have more time to explore alternative choices and consider other sources of information. Closer deadlines put an extra pressure on customers affected by a scarcity signal, so as not to miss out on the scarce product.

THE PRODUCT BELONGS TO A WIDE ASSORTMENT. Facing (too) many options, customers who browse wide assortments may suffer a cognitive overload and thus rely on the most salient information – such as the low availability signals that the firm displays noticeably – to make up their minds.

SCARCITY SIGNALS ARE SUFFICIENTLY ABUNDANT. Customers with limited attention tend to overlook scarcity signals when they are sporadic. Consequently, online retailers should not fear sending many conspicuous alerts to customers.

Mobile customers are less sensitive to scarcity signals than those who purchase through a non-mobile device

CUSTOMERS USE LARGER SCREENS. Mobile customers are less sensitive to availability information compared with those who purchase through a non-mobile device. We speculate this may be a consequence of smaller screens obstructing the visualization of scarcity signals.

Although these insights were derived in the context of "flash sales" retailing, we studied not just one but thousands of brands, dozens of verticals and hundreds of thousands of active customers over the span of a year. As such, we believe these results can be generalized across many situations and leveraged by other companies competing in the online retail space. Granted, companies will have to take their own context into account: a context where product replenishment is possible isn't the same as one where products are gone
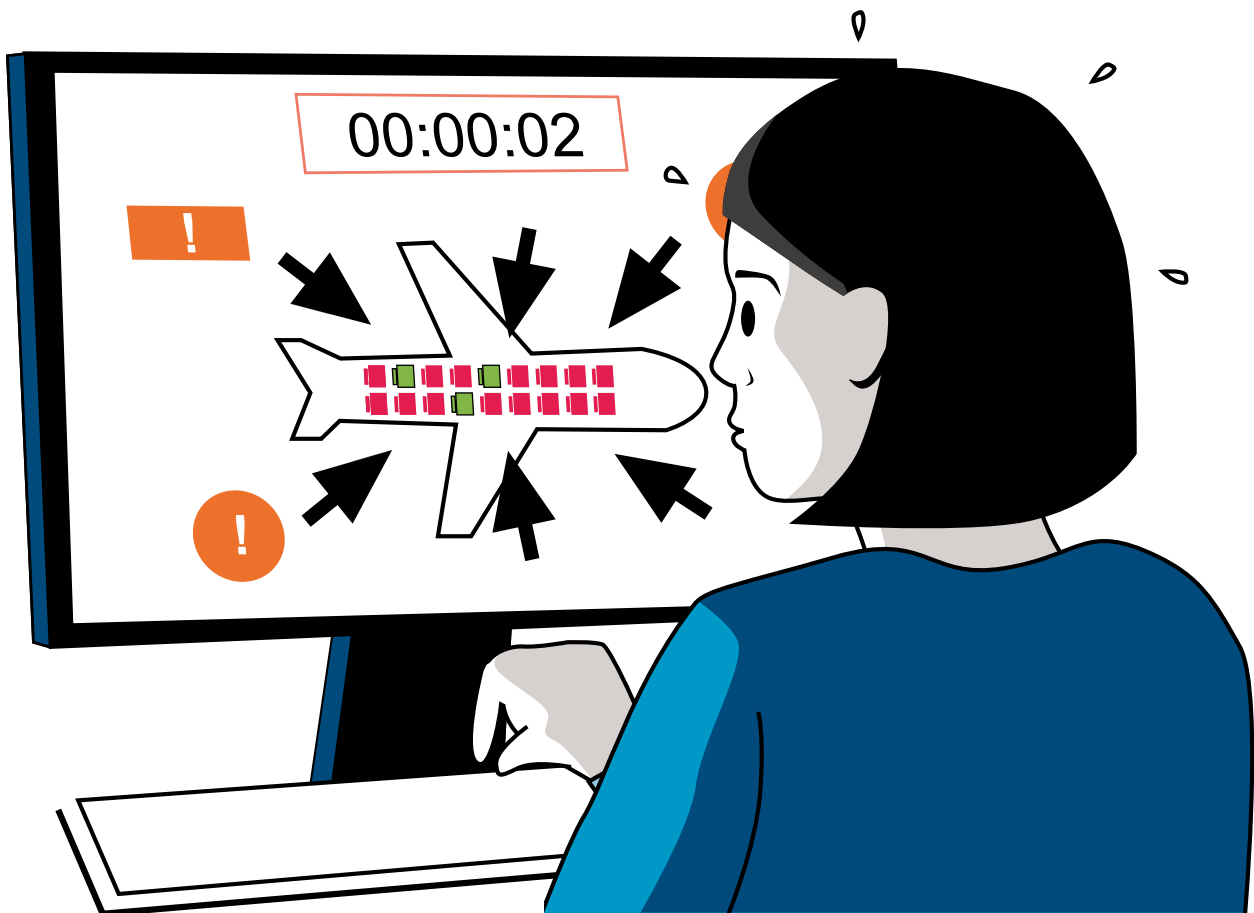
once they sell out, so customers' reactions to scarcity signals will be different and the previously described effects may be less. Still, these characteristics give companies some guidance to help tailor their information disclosure policies accordingly.

Take our finding that disclosing product availability boosted sales but also returns. If we recognize that tendency, then setting a fixed disclosure threshold becomes suboptimal: any value will be too high for the bestsellers that would probably sell out anyway, and too low for the slow movers that most need a push to avoid a sales standstill. By tuning the disclosure of product availability according to the unique context of each product, we can exploit our understanding of these effects to lift sales without spiking returns.

We propose a data-driven policy to prescribe the timing of the disclosure of scarcity signals for each individual product according to an optimal stopping time logic. Once a product is put on sale, we can use machine learning to periodically compare the estimated profit-to-go: 1) if we disclose its availability right away; with 2) if we postpone this decision one more period. Then, we can make a decision accordingly. The model estimation would need to be tailored to the specific context, but the design principles of our policy apply to any retailer able to disclose product availability independently. The value of data-driven disclosure policies will be higher for online retailers who get frequent and costly returns, and who are able to disclose availability at variable inventory levels.

Use these results honestly

In sum: Revealing low product availability to customers is an effective tool for boosting sales and profits in online retail. Moreover, scarcity signals are most powerful when they are abundantly released and involve deeply discounted products sold within wide assortments, and whose campaigns are close to the end. Conversely, these signals are least useful when they are seldom released and involve moderately discounted products sold within narrow assortments, and whose campaigns have plenty of time left.

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Online retailers can convert these causal findings into enhanced practice via the use of data-driven policies. Contingent upon the availability of data with enough variation, retailers can use machine learning to prescribe the timing of the disclosure of scarcity signals in light of the ever-changing context of each individual product.

It should go without saying that the managerial prescriptions of our results should be honestly executed. There are limits to how far retailers can go when engineering their disclosure policies with the aim of encouraging a purchase. However tempting it might be, manipulating scarcity signals to a point at which they become untrustworthy is not only unethical but also illegal. ■