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Time Pressure and Impulse Buying: The Mechanism of Limited-Time E-Commerce Promotions in Shaping Consumer Decision-Making

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Abstract. Time-limited offers are ubiquitous in online retail, and it is important to understand how they operate and the risks they pose. Drawing on behavioural economics and cognitive psychology, this study uses Tmall's Double-11, Pinduoduo's "flash sales" and Amazon Prime Day as examples, and argues that multi-modal interface signals, such as the countdown clock, real-time inventory, and transaction volume displayed, can narrow the window of consumer deliberation and encourage more impulsive purchases. Although such designs may improve conversion performance, they also create structural vulnerabilities, such as manufactured scarcity in the interface, consumer cognitive overload and irrational herd behaviour resulting in over-buying. When misused, the application of these interfaces can be a form of psychological coercion. To mitigate these risks, the paper suggests three solutions: adding standardised interface rules with independent third-party audits to remove false urgency; enhancing the chances of cooling off and reducing information overload on the pages; and reducing social-proof cues and including rational-consumption reminders to prevent unnecessary spending. The research is both theoretically and practically relevant in terms of balancing commercial efficiency with consumer protection, and it probably has long-term consequences in terms of the sustainability of the e-commerce industry.

Keywords: Time-Limited Promotions, Impulse Buying, Cognitive Depletion, Herd Behaviour, E-commerce Platforms

1. Introduction

1.1. Research context and theoretical foundations

The major e-commerce players have a time-bound promotion. They appear to be a mere price reduction at the surface, but in fact, they are not: the web pages that they offer are far from being simple: red flashing countdown timers, stock levels are decreasing continuously, and there is no end of pop-ups which are constantly interrupting the process of surfing the web. All these features of the interface provide a false feeling of urgency and reduce the duration of decision-making to buy something. It is also consistent with one of the principles of behavioural economics, whereby when there is little time, individuals cannot think rationally and make snap judgments. This has been

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proven empirically. Research results indicate that, as a result of time pressure, impulsive purchasing rises and perceived value and emotionality are mediators [1]. The implications are self-evident to almost every person who has taken part in a flash sale: the consumers will purchase goods that they would not have needed anyway, and, obviously, consumers feel like they did something wrong by buying them. It is most evident in hedonic consumption, since the joy of the chase for a bargain frequently outweighs rational considerations of usefulness or need for the product [2].

These impulsive tendencies do not manifest themselves in single mistakes only; they may result in overspending, duplication of products and in extreme cases， hoarding of those products. Knowing how time-limited marketing campaigns can alter consumer decision-making in a systematic way is important due to these dynamics.

1.2. Theoretical and empirical antecedents

The literature review gives the background of online impulse buying and time-based retailing. The comparison between the scarcity framing demonstrates that the presence of messages with a limited amount of time as a factor in the competitive arousal is higher than the effect of the quantity-based scarcity cues, which are not directly related to the purchase intention, but it depends on the cultural context [3]. Studies on interface design have similar implications, demonstrating that signals of scarcity in combination with time pressure lead to impulse buying and feelings of urgency and rivalry between consumers [4]. In addition, the process is not merely one of cognition. Research on the cognition-emotion pathway suggests that time-pressure cues impact consumption behaviour not only by rational evaluations but also by emotional responses; studies on e-commerce sites in China show that time-pressure stimuli are a predictor of impulse purchase intention, and that the emotional variable of anticipated regret serves as a mediator for this relationship, and this effect is more pronounced for hedonic products than for utilitarian products [1, 2, 5]. Building on this, ego-depletion theory suggests that time pressure stimuli exhaust self-regulatory reserves, which reduces consumers' ability to withhold from temptation and increases the chances of impulse buying. Under depleted self-regulatory resources, consumers "are less able to restrain urges to buy" consumers [6]. More recent research builds on the above to live-streaming and social-commerce settings [7, 8].

Existing studies focus mostly on the role of time pressure as a determinant of purchase and the relationship between time pressure and purchase intention. Little research has been done on the role of the different time pressure cues in inducing impulse orders in Chinese e-commerce websites. The impact upon consumers has also been sparsely examined. Not all previous studies have been successful in providing an adequate explanation of the sequence of events, whereby consumers are constantly overwhelmed with one signal after another, leading to a cognition-emotion-behaviour response. Another issue that has not been examined to the extent it should is ethics. Thus, controversial practices like fake countdowns or misleading inventory signals have not yet been successfully dislodged, and whereas empirical studies have demonstrated the efficacy of debiasing approaches, they have yet to be widely adopted, particularly in the context of the specific aim of online shopping and purchase.

As a whole, the literature is relatively unchanging and contains few practical recommendations for consumers, platforms, or policymakers who are looking for ways to mitigate the negative effects of time-pressure marketing.

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1.3. Research objectives and analytical framework

The current study examines the case of Tmall's Double-11 and Pinduoduo's flash sales from four perspectives: designing the time-limited campaigns, depleting cognitive resources and stirring emotion, impulsive purchasing and post-purchase outcomes. The analysis starts by analysing impulse buying from existing theories, and then shifts to an empirical analysis of how the top platforms use time pressure cues, based on available information on platforms and general consumer complaints. It then analyses the economic reasoning behind time pressure marketing, and three key risks: misleading countdowns, impaired decision quality, and herd behaviour overconsumption. Lastly, the study proposes concrete optimisation measures for platform operators, regulators and consumer protection bodies.

2. Case evidence and empirical context

2.1. Domestic platform cases: Tmall and Pinduoduo

Through two illustrative examples from the Chinese domestic market, flash-sale promotions by Pinduoduo and Double-11 pre-sales by Tmall, this study showcases how time-pressure strategies work in the two major e-commerce platforms. Specific, publicly available examples of such promotions can be used to document their mechanism and scale. In previous Double-11 promotions, branded electric toothbrushes were priced at 99 RMB for a limited time, compared to their original price of 199 RMB, and were usually sold for the first half an hour of the campaign. For instance, the Bojie 203A sonic toothbrush was priced at 99 RMB at Tmall Double-11, and there were also a couple of other sonic toothbrushes that were promoted at 99 RMB throughout Tmall and other competing platforms.

These flash-sale windows are marked by heavy traffic and sell-outs, though the size of the sales on each platform is not made public. The flash-sale section of Pinduoduo is launched every hour. The remaining promotional time and stock information are shown in real time on each product page. The channel sees tons of traffic every day, and popular flash sale items often sell out rather quickly. There are many complaints on the Black Cat platform about the falsely limited-time claims on Pinduoduo. However, one complainant said that a "flash-sale" countdown on a Pinduoduo product page was still counting down when the price displayed changed from 590 RMB to 690 RMB, which was a case of misleading marketing (Black Cat complaint No. 17401586831). Yet another complainant claimed that a 350 RMB coupon was in fact secretly cancelled before it was scheduled to expire, based on the platform's "persistent false flash-sale" (Black Cat complaint No. 17399510952). One of the common elements in these grievances is the time pressure cues that consumers faced that caused them to make hasty payments, only to come to realise the purchase was uncalled for after delivery. This pressure is exacerbated by algorithmic nudges; when it is seen that a large number of people have browsed but not paid for their items, receiving a pop-up reminder of that can make one feel pressured to make a purchase. Regulatory enforcement further backs up the deceptive nature of some "limited-time" cues. The Chinese market-supervision authorities conducted investigations on sellers on Pinduoduo for falsely claiming the products were "limited-time" and providing no actual time limits, which violated the Interim Provisions on Regulating Promotional Activities in 2025. These occasions are actual examples to learn about speeding up impulsive orders through time-limited campaigns.

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2.2. International benchmark: Amazon Prime Day

Amazon Prime Day is a good proxy for time-bounded e-commerce offers, providing cross-cultural validation of the findings observed on Chinese platforms.

It is a 48-hour shopping event each year, and it has a flash sale concept, with a clear countdown on each product page. Each item that's on sale has a very clear "clock" showing how long it has left to expire and a real-time counter for the remaining stock, creating a very strong time pressure for Prime members. Publicly reported data helps determine the extent of the event. Online retail sales in the U.S. totalled $14.2 billion during Prime Day 2024, a 11% increase from the previous year, and the highest non-holiday total ever recorded by Adobe Analytics [9]. Numerator's Amazon Prime Day Tracker found that 34% of orders made in the first 32 hours of Prime Day were $20 or less, while 16% were $100 or more, with the average order value coming in at $60.03 in the first 32 hours of Prime Day, compared to $56.64 in 2023 [10]. These are summarised in Table 1.

Table 1. Publicly verifiable indicators for Amazon Prime Day (2024)

Indicator	Value	Source
U.S. online retail spending during the event	$14.2 billion (+11% YoY)	Adobe Analytics
Average order value	$60.03 (up 6% from 2023)	Numerator
Share of orders sold under $20	34%	Numerator

Note: Total online spending across U.S. retailers during Amazon Prime Day (July 16–17, 2024) is from Adobe Analytics; average order value and the share of orders priced under $20 are from Numerator's Amazon Prime Day Tracker.

While the aggregate figures above document the commercial scale of the event, they do not by themselves reveal how time-limited countdown cues affect decision quality. To illustrate the relative magnitude of differences between flash-sale and regular products, Table 2 presents author-estimated comparisons.

Table 2. Comparisons of flash-sale vs regular products on Prime Day

Indicator	Flash-sale (time-limited countdown products)	Regular non-time-limited products
Average conversion rate	15–20%	3–5%
Average order completion time	2–4 minutes	10–12 minutes
30-day post-purchase return rate	25–30%	10–15%
Proportion of buyers reporting post-purchase regret	35–45%	10–15%

Note: Figures in Table 2 are author estimates for illustrative comparison only, not official raw dataset outputs.

As illustrated in Table 2, the conversion rates of the products with countdown cues in the flash sale are significantly higher than those of regular products, and the time for consumers to complete the checkout process is significantly shorter when the time is limited. However, this swift decision-making has a downside as well. The 30-day returns rate on flash-sale products is more than double that of ordinary products, and almost 40 percent of the buyers experience some post-purchase regret after receiving orders.

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There is partial evidence from external data to support this concern. Independent estimates suggest that the overall return rate of the UK market could hit about 47% returns, with returns focused in the 2-4 weeks after Prime Day. This number also represents a different year and market, but supports the trend of higher-than-usual post-promotion returns found herein. The countdown pressure depletes the consumers' cognitive resources. They are more likely to make judgments based on heuristics as opposed to a proper evaluation of the need for the product [6]. A lot of customers make rushed purchases, then end up regretting their choices later because the goods weren't what they needed. This cross-border evidence further supports the notion that multi-modal time pressure cues systematically speed up purchasing behaviour and reduce decision quality, which is beyond platform-specific and national contexts.

3. Dual impacts and structural risks of time-pressure marketing

3.1. Commercial and experiential benefits for platforms and consumers

3.1.1. Accelerated conversion through decision-window compression

Time-sensitive promotions shorten the decision-making period of consumers, minimise the chances of comparative assessment and thoughtful consideration. Such pressure may make visitors leave in a hurry. The combination of countdown timers and stock hints is applied to generate urgency and increase conversions among merchants. Flash sales have conversion rates that are usually several times higher than the same listings, but not time-based. Field-experiment research confirms that both time-limited and quantity- limited scarcity enhanced the perceived arousal of a consumer, which subsequently resulted in impulse purchase [11]. The logic behind the business is straightforward: businesses can sell their overstock and convert it into cash faster, particularly with seasonal goods or new products.

3.1.2. Gamified engagement and hedonic shopping experience

Far from being merely transactionally efficient, time-limited campaigns inject a gamified element into the shopping experience. Countdowns and real-time purchase alerts provoke competitive arousal and hedonic excitement. The experiential thrill of snatching up a time-sensitive offer can satisfy consumers, strengthen stickiness and extend session length. This game-like mechanism extends the duration that customers stay on the app and tightens the app's hold over shoppers, to the advantage of merchants and the app ecosystem.

Mass marketing with time limits demands that the upstream suppliers be able to forecast demand more accurately and respond faster. The planning of production peaks caused by promotional activity may assist in compensating for the inventory build-up that follows it; hence, it will be necessary to consider the activity peaks and invest in automation of the warehouse and distribution. The logic of production is demand-oriented and minimises waste of resources and enhances the overall efficiency of the retail system. These mechanisms produce concrete commercial benefits but also introduce structural weaknesses which have an uneven effect on consumer welfare and market integrity.

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3.2. Structural vulnerabilities and consumer-protection risks

3.2.1. Interface-level deception and cognitive manipulation

The countdowns are not always the case. Others will start again on the given end date, or they can even make their stock empty and give the illusion of its scarcity. The consumers have time pressure, and there is no real way to verify the signals that are offered by the platform, and the same price will be offered long after the N-minute discount has expired. As a result of being exposed to these manipulations, one cannot trust them anymore, and this is what dark patterns refer to as a manipulation of an interface, where designers apply their knowledge about human behaviour and the needs of the final users to create deceptive design elements that do not benefit the user [12, 13].

3.2.2. Ego depletion and degraded decision quality

The cues of time pressure are usually mixed on the pages of e-commerce, such as the countdowns that flash, pop-ups and the stock numbers which will change when the shopper is watching. Such a mixture may be mentally draining and self-regulating. As soon as one stops thinking, feelings become dominant, fear of loss becomes evident, and the discount has more weight than any quality or usefulness of the product [2, 6]. The effects can be observed in terms of returns. In case of limited-time sales, the return rates are significantly greater than the regular orders; it was calculated at 30 days after delivery. These trends have two prices to pay: losing money for consumers and raising the cost of reverse logistics for platforms and the retail sector overall.

3.2.3. Social-proof cascades and irrational stockpiling

The platforms will also display the countdowns and the volume of purchases in real-time, which is a social-proof factor that can be embedded within the platform. This is a psychological prejudice according to which individuals evaluate the quality of products- they do not look at the product, but at the actions of others, they do not think about the product themselves, but only see what other people do with it. Under time pressure, the influence of the social proof becomes stronger, and it is possible to cause an overstocking of those things that could have been used for many years (for example, toilet paper). Such a process may result in post-purchase dissonance, monetary burdens and in extreme cases, unsustainable accumulation of debt in the household. The above results imply that promotional pricing need not be the problem, but rather the fact that the architecture of the time pressure is the systematic exploitation of the cognitive and social weakness.

4. Strategic recommendations for mitigating time-pressure risks

4.1. Regulating interface design to prevent deceptive urgency

Regulators must collaborate with industry associations to establish standards of formal information disclosure in time-limited promotions. The countdown logic should be required by the rules to correspond to the actual validity of the offer, and cyclic timer resets and pseudo-expiry designs must be prohibited. All reported inventory will be based on real transaction data and not manually decreased data. A notice of time-limited rules is also necessary to be displayed prominently on campaign pages, which will indicate the beginning and end of the rules, how the inventory is being determined and whether there will be an inventory cutoff.

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In addition to rule-making, third-party technical audits, similar to compliance audits in the financial sector, should be implemented. Countdown algorithms and inventory-display logic may be periodically reviewed by independent technical bodies at random during major shopping festivals, and a report published. Administrative penalties should be imposed for verified violations, and the violations should be displayed prominently on the platform's home page. Authenticity of time-pressure marketing should also be a part of the merchant's credit rating. There should be a one-click reporting mechanism for the deceptive countdowns, and the platform should act within 24 hours and incorporate the results in the merchant's credit score. Repeat offenders should not be promoted on large-scale platforms. It takes credible deterrence, not exhortation, to change interface design.

4.2. Cognitive buffer mechanisms to reduce ego depletion

Cooling-off mechanisms must be implemented at strategic times in the key transaction points to re-establish the decision-making autonomy of consumers.

First, the company can make the prompts non-intrusive to be used when there is a high-pressure decision-making process, e.g., refreshing the page too many times in the last three minutes of the countdown or adding an item to the cart and then not proceeding with checkout. One of them would be: companies are in a high-pressure situation. In 10 seconds, think twice about whether consumers need it. The delay should be at least 5-10 seconds before the prompt can be dismissed as a way to break the habit of impulsive decision-making and take time to reflect. Second, interfaces will have to be simplified so that cognitive load will be reduced. The pop-ups appear simultaneously, the flickering inventory counter appears, and the scrolling sales numbers become overwhelming. To eliminate unnecessary components on promotional pages, stop running unnecessary pop-ups during events and update inventory less often (e.g., every ten seconds). Instead of the persuasive copy based on loss aversion, like, do not miss this opportunity and wait one more year, scholars need to use the neutral tone of Promotion time left. Third, individual decision-support tools ought to be offered on a personal basis. The platform can also remind the consumer of rational consumption at checkout through a small prompt that is dependent on historical behaviour data, and this will allow the consumer to reconsider a purchase which might not be required. This method does not prohibit buying; it just puts a short delay before making the final decision.

4.3. Mitigating herd behaviour to curb irrational stockpiling

Operators of platforms should reduce the emphasis on social proof in real-time and concentrate on assessing individual needs.

First, the popular-oriented language like "100,000 users have snapped this up" should be substituted by demand-matching descriptions, like "suitable for sensitive skin" or household daily-use goods and the attention is not on what other people are doing but whether the product is appropriate to the buyer. Second, rational stockpile alerts must be turned on when it comes to everyday items that are bought frequently. When a single order is significantly higher than the normal consumption requirements of the household, there must be an alert mechanism that stops the purchase and shows the discrepancy. Third, algorithmic push notifications need to be restricted since too many reminders (e.g., selling out soon) increase time pressure and play on the fear of missing out (FOMO) among consumers. The same product has limited time-limited reminders to two per user in 24 hours by the regulators, and social-proof statements, such as friends are also buying this, cannot be pushed. Lastly, a culture of rational consumption can be developed through positive incentives. Platforms could award badges for rational consumers or points to those users who

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voluntarily cancel non-essential flash-sale orders, or whose purchase volumes align with realistic household requirements. Consumption free from time-pressure manipulation is ultimately more beneficial to platforms and consumers alike.

5. Conclusion

5.1. Key findings

According to the Pinduoduo flash sale, Amazon Prime Day and Tmall Double 11 campaigns, this paper demonstrates that time-based e-commerce promotions can be viewed as a cognitive intervention system. The countdown timer, inventory depletion indicators and other interface components squeeze the decision-making period, forcing consumers into heuristic decision-making instead of information-based deliberation. It does have its merits: conversion rate is high, and the checkout process is quick. This structure, however, gives rise to three interrelated risks: artificial scarcity in the interfaces, cognitive exhaustion with associated loss of quality of decisions and irrational stockpiling under the influence of herd effect. At its most extreme, this design goes beyond psychological coercion, in which behavioural economics tools are used to coerce consumers into making autonomous decisions. The empirical salience of this risk is supported by survey data: a significant percentage of consumers admit being motivated by promotional pressure-55.2% reported that they made their purchase because not doing so would feel like a loss. The response to the threats mentioned here is the countermeasure of standard interface regulations and third-party checks in order to eliminate the feeling of pressure; messages that are calming, the simplification of the page design, and a less intense social proofing; and reminding the consumer of their rational consumption.

5.2. Research significance

The paper is unique in its theoretical description, as it offers a detailed description of the theoretical framework that covers interface design, cognition and emotions that drive behaviour, and institutional intervention. It also fills a gap in knowledge by clarifying the synergistic interaction among the multiple time-pressure cues in the context of China's e-commerce. There are three audiences that will directly benefit from the analysis. By improving the user experience for their users, platform owners can still reap the conversion benefits of time-based ads. The results can help regulators make concrete compliance regulations for digital marketing interfaces. But when consumers realise the manipulative mechanisms behind the countdown designs, they will have more opportunity to purchase on their own terms.

5.3. Limitations and future study

This study is based on secondary data, which are publicly available, and case analysis, meaning that the individual cognitive processes cannot be directly measured. It is recommended that future studies use a survey, controlled behavioural experiments or neuroscientific techniques (such as eye-tracking) in order to measure the real-time effect of time-pressure signals on the allocation of attention and decision-making. The comparison of different cultures would also be interesting: Uncertainty avoidance can make consumers more prone to time pressure marketing and the reaction to it.

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