Shrinkflation

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Abstract

To sustain profitability amidst rising production costs and avoid direct price increases, firms often resort to shrinkflation, reducing product sizes. This paper shows that the presence of inattentive consumers, who may not notice subtle decreases in product size, results in higher per-unit prices, especially in less competitive markets. Shrinkflation diminishes the utility of all (attentive and inattentive) consumers, necessitating regulatory action.

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1 Introduction

Amid supply shocks or other factors that inflate production costs, companies may choose to pass on cost increases to consumers to sustain profitability. Because direct price hikes can be detrimental to firms in competitive markets, they often choose to raise prices indirectly through product downsizing. The "Shrinkflation Prevention Act", introduced on February 28, 2024, serves as a legislative measure to curb shrinkflation, where companies reduce the size of their products, increasing the per-unit prices.[1] The reduction in product size is usually small, making it not readily apparent to some consumers.[2]

This paper uses an oligopoly model to study shrinkflation with inattentive consumers. Firms, competing in a linear market, choose prices and product quantities, assuming some consumers believe product sizes remain constant. We show that firms reduce product sizes to maintain margins, leading to higher per-unit prices, especially in less competitive markets. Inattentive consumers exacerbate this effect, harming all consumers. Regulatory measures promoting transparency can mitigate shrinkflation, increasing product quantities, lowering per-unit prices, and enhancing consumer welfare.

The existing literature primarily studies shrinkflation through field experiments or empirical analysis. Janssen and Kasinger (2024) find that shrinkflation is a common strategy among both manufacturers and retailers. Yao et al. (2020) and Kim (2024) argue that consumer demand is less sensitive to changes in product size compared to changes in price, and that the display of per-unit prices facilitates more informed purchasing decisions among consumers (see also Russo (1977), Yan et al. (2014)). Similarly, Evangelidis (2023) finds that a larger proportion of consumers deems downsizing more unfair compared to price hikes. Chetty et al. (2009) in a tax experiment, offer evidence of consumer inattention and highlight the significance of price salience. By analyzing variations in tuna can sizes, Harris-Lagoudakis et al. (2023) estimate the welfare increase from per-unit price disclosure regulations for consumers in unregulated U.S. states.

To the best of our knowledge, this paper represents the first attempt to study shrinkflation within a theoretical framework. It can be linked to the theoretical literature that studies hidden fees (Gabaix and Laibson (2006), among others). The quantity reduction in our model can be viewed as an increase in the 'hidden' price in that literature.

2 Firm choices in the presence of inattentive consumers

The market features two profit-seeking firms 1 and 2, indexed by i and j, where $i \neq j$. Firms simultaneously choose their per-item price, f_i, *and* the quantity (size) of the product, q_i, to maximize their profits.

[1] For more details see: https://www.congress.gov/bill/118th-congress/senate-bill/3819/text.

[2] In 2020, Unilever reduced the size of Ben & Jerry's ice-cream tubs in Europe from $500ml$ to $465ml$, while maintaining the same price. More recently, Unilever reduced the size of Dove soap bars from $100g$ to $90g$. Procter & Gamble reduced the number of double-ply sheets per roll of toilet paper from 264 to 244 sheets in the 18-count mega package.

Each competitor sells a horizontally differentiated product and each consumer has an inverse demand $p_i = 1 - q_i$, where p_i is the per-unit consumer willingness to pay. In this setup, the firms incur the same per-unit production cost $c \in [0, 1)$ and are located at the endpoints of the unit interval $[0, 1]$. The consumers are uniformly distributed over this interval. A consumer located at x incurs a 'transportation cost' of tx when buying a product from firm 1 who is located at 0, and $t(1 - x)$ when buying a product from firm 2 who is located at 1, with $t > 0$ being a product-differentiation parameter that determines a firm's market power. The utility function of a consumer, who is located at a distance x from firm 1, is

$$U = \begin{cases} v + q_1 - \frac{q_1^2}{2} - f_1 - tx, & \text{if purchasing from firm 1,} \\ v + q_2 - \frac{q_2^2}{2} - f_2 - t(1 - x), & \text{if purchasing from firm 2.} \end{cases}$$

Each consumer enjoys the benefit $v + q_i - \frac{q_i^2}{2}$, where $v > 0$ is a fixed benefit from consumption that is sufficiently high to ensure that the market is covered, and $q_i - \frac{q_i^2}{2}$ measures the area below the inverse demand curve, capturing the variable benefit derived from consuming a product of size q_i. The consumer who is indifferent between purchasing from either firm is located at

$$\hat{x} = \frac{f_2 - f_1 + t}{2t} + \frac{(2 - q_1)q_1 - (2 - q_2)q_2}{4t}.$$

Inattentive consumers overlook changes in product size and focus solely on price changes. This implies that q_1 and q_2 will no longer affect the location of the marginal inattentive consumer, which is

$$\tilde{x} = \frac{f_2 - f_1 + t}{2t}.$$

We assume that at every point $x \in [0, 1]$, a fraction $a \in [0, 1]$ of consumers is inattentive, while the remaining fraction $1 - a$ of consumers is attentive, where $a < 1 - c$.[3] Firms' profit functions are

$$\begin{aligned} \pi_1 &= (f_1 - cq_1)\left[(1 - a)\hat{x} + a\tilde{x}\right], \\ \pi_2 &= (f_2 - cq_2)\left[(1 - a)(1 - \hat{x}) + a(1 - \tilde{x})\right]. \end{aligned}$$

To maximize profits, firms simultaneously choose their per-item prices as well as the quantity of their product.[4] In equilibrium, all consumers purchase a product of quantity

$$q_i^* = 1 - \frac{c}{1 - a}, \tag{2.1}$$

at total per-item price

$$f_i^* = c + t - \frac{c^2}{1 - a}. \tag{2.2}$$

[3] This is equivalent to assuming that each consumer in the market is inattentive with some probability, as in Gabaix (2019). Also, the assumption $a < 1 - c$ ensures that the equilibrium quantities and per-item prices are positive.

[4] The second-order conditions are satisfied.

The equilibrium per-unit price of the product is

$$\frac{f_i^*}{q_i^*} = c + \frac{1-a}{1-a-c}t. \tag{2.3}$$

To study shrinkflation, we analyze the effects of cost increases on both product size and per-unit price.

Proposition 1 *As the per-unit production cost c increases,*

(a) the equilibrium quantity of the product decreases, $\frac{dq_i^*}{dc} = -\frac{1}{1-a} < 0$,

(b) the equilibrium per-item price exhibits an inverse U-shape: $\frac{df_i^*}{dc} = 1 - \frac{2c}{1-a} > 0$, *if and only if,* $1 - 2c > a$,

(c) the equilibrium per-unit price increases, $\frac{d(f_i^*/q_i^*)}{dc} = 1 + \frac{1-a}{(1-a-c)^2}t > 0$.

In equilibrium, each firm responds to an increase in production cost by decreasing its quantity, q_i^*, which results in an increase in the per-unit price, $\frac{f_i^*}{q_i^*}$. Note that

$$\frac{d(f_i^*/q_i^*)}{dc} = \frac{d(f_i^*/q_i^*)}{dc}\bigg|_{q_i^* = \text{fixed}} + \frac{d(f_i^*/q_i^*)}{dq_i^*}\frac{dq_i^*}{dc} = \frac{1 - \frac{2c}{1-a}}{q_i^*} - \frac{f_i^*}{(q_i^*)^2}\frac{dq_i^*}{dc} = 1 + \frac{(1-a)}{(1-a-c)^2}t. \tag{2.4}$$

As costs rise, there is a positive direct effect on per-unit prices (which is present even under unitary individual demands): holding quantity fixed, costs get passed through, leading to an increase in per-unit prices. There is also an indirect positive effect through the reduction in quantity. Note that the equilibrium per-item markup $f_i^* - cq_i^*$ remains constant and equals t, implying that $\frac{f_i^*}{q_i^*} = c + \frac{t}{q_i^*}$, which is an alternative expression of (2.3). This holds true regardless of the cost c or the fraction of inattentive consumers a. Essentially, when product quantity decreases, a constant per-item markup is spread across fewer units. Hence, any decrease in quantity must be associated with a further increase in the per-unit price, $\frac{f_i^*}{q_i^*}$, implying that the pass-through rate of per-unit costs to per-unit prices is greater than 1.

When all consumers are attentive, $a = 0$, the equilibrium quantity given by (2.1) is efficient, as $p_i = c$. Thus, shrinkflation occurs and is efficient even when $a = 0$. However, empirical literature (e.g., Heidhues and Kőszegi (2019)) documents that many consumers are inattentive.

In equilibrium, as the fraction of inattentive consumers a increases, both the quantity of the product and the per-item price decrease, $\frac{dq_i^*}{da} = -\frac{c}{(1-a)^2} < 0$ and $\frac{df_i^*}{da} = -\frac{c^2}{(1-a)^2} < 0$, while the per-unit price increases, $\frac{d(f_i^*/q_i^*)}{da} = \frac{tc}{(1-a-c)^2} > 0$. Proposition 2 highlights the effect of consumer inattention on shrinkflation.

Proposition 2 *As the fraction of inattentive consumers a increases,*

(a) the reduction of quantities due to cost increases is exacerbated, $\frac{d^2q_i^*}{dcda} = -\frac{1}{(1-a)^2} < 0$,

(b) firms decrease the per-item price more or increase it less when cost rises, $\frac{d^2f_i^*}{dcda} = -\frac{2c}{(1-a)^2} < 0$,

(c) the increase in the per-unit price due to cost increases is exacerbated, $\frac{d^2(f_i^*/q_i^*)}{dcda} = \frac{1+c-a}{(1-a-c)^3}t > 0$.

Shrinkflation is more effective for the firms in the presence of inattentive consumers. These consumers always underestimate the increase in per-unit prices because they disregard the indirect effect shown in (2.4). Thus, they perceive the increase in per-unit prices as being smaller than it actually is, benefiting the firms. Interestingly, the fraction of quantity reduction as costs escalate, due to inattention, is equal to the fraction of inattentive consumers

$$\frac{\frac{dq_i^*(a)}{dc} - \frac{dq_i^*(a=0)}{dc}}{\frac{dq_i^*(a)}{dc}} = a.$$

When a large fraction of consumers is inattentive, consumer inattention is responsible for a sizeable portion of shrinkflation.

Proposition 3 highlights the impact of competition on shrinkflation.

Proposition 3 *The increase in equilibrium per-unit price, as costs rise, is more pronounced in less competitive markets,* $\frac{d^2(f_i^*/q_i^*)}{dcdt} = \frac{1-a}{(1-a-c)^2} > 0$.

Shrinkflation is more effective for sustaining profits for firms in less competitive markets, where greater market power allows them to raise per-unit prices. In contrast, strategic interactions among firms in highly competitive markets result in lower listing prices, diminishing the effectiveness of shrinkflation.

In equilibrium, each consumer experiences utility[5]

$$U^* = v + \frac{1}{2} + \frac{(1-2a)c^2}{2(1-a)^2} - c - t(1+x), \text{ where } x \in \left[0, \frac{1}{2}\right].$$

Proposition 4 *As the number of inattentive consumers increases, the utility of all consumers decreases,* $\frac{\partial U^*}{\partial a} = -\frac{ac^2}{(1-a)^3} < 0$.

Inattentive consumers impose a negative externality on rational consumers.[6] Inattentive consumers also decrease social welfare as the product quantities are below the efficient levels. Overall, our analysis suggests that implementing transparency policies aimed at reducing a will result in increased product quantities and reduced per-unit prices, as well as enhanced consumer utility and social welfare.

[5]The utility is symmetric for $x \geq \frac{1}{2}$.

[6]In certain markets - e.g., insurance markets - inattentive consumers can enhance efficiency by mitigating the problem of adverse selection (Heidhues and Kőszegi (2019)), but this is not the case in our model.

3 Discussion and concluding remarks

This paper shows that as costs rise, firms increase per-unit prices through product downsizing, especially in less competitive markets. Inattentive consumers, who overlook size reductions, allow firms to further reduce product sizes. Inattention harms consumer and social welfare, highlighting the need for regulatory intervention.[7]

Our model shows that when all consumers are attentive, firms use shrinkflation to pass on cost increases, and that the presence of inattentive consumers leads to further reductions in product quantity. Therefore, we advocate for regulations that promote transparency and awareness of package size changes, rather than an outright ban. Transparent unit pricing will help consumers recognize price increases caused by shrinkflation.

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[7] Low-income households are particularly affected, as they spend a significant portion of their budget on numerous essential items and may miss subtle size changes.

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