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## Laggards in disguise: Resistance to adopt and the leapfrogging effect<sup>☆</sup>

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### Abstract

In this conceptual paper we propose a redefinition of the *Laggards* concept and discuss a *consumer leapfrogging effect*, whereby Laggards of previous product generations may often become the Innovators of the most recent generation. We then examine the potential financial benefits to be gained by addressing this resistant population.

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*Keywords:* Laggards; Innovators; Innovation; Growth process; Adoption process; Resistance to change

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### 1. Introduction

They are called Laggards; the marketing literature pays them little attention, and managers typically ignore them. Laggards constitute one of the five segments identified by Rogers [1] and have been defined as those who are last to adopt an innovation (following Innovators, Early Adopters, the Early Majority and the Late Majority). Although some understanding of the Laggard phenomenon can be gained through

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studies that examine switching behavior (e.g., [2]), research on Laggards has been quite scant. This is likely driven by the assumption that their resistance to change is so strong, and that the point in time in which they ultimately adopt is so late, that for all practical purposes, one might as well consider them a lost market that only adopts when having no choice.

Because research on late adopters has been so scant, we do not know much about the size of this group. Rogers [1] classified the five consumer segments using standard deviations in a normal distribution. Accordingly, he argues that Laggards constitute 16% of the market. Mahajan et al. [3] defined the Laggard segment on the basis of the adoption slope's last point of deflection. Using a diffusion model, they estimated lagging consumers to comprise 21.9% of the market.

Several empirical works have linked exploratory consumer behavior (i.e., early adoption) to novelty seeking [4]; to tolerance for ambiguity, low cognitive rigidity, and low dogmatism ([5,6]); and to cognitive innovativeness [7]. These studies were motivated by the desire to understand the psychological mechanisms that account for early adoption. While we can be relatively certain that Laggards differ in their characteristics from Innovators, we still lack a framework that focuses on Lagging.

Demographically, Laggards have been characterized by low incomes [3,8], low levels of education [3,1,8], low social status, and low social mobility [1]. Such characterizations suggest that lagging constitutes a stable characteristic, which therefore does not warrant any further investigation or investment. In this conceptual paper we try to convince why we *should* be interested in highly resistant consumers and will argue that, due to what we call the *consumer leapfrogging effect*, their economic impact is considerably underestimated.

## 2. The consumer leapfrogging effect

Consider John, who enjoys listening to music as he jogs every morning. John uses his 1985 Walkman and is used to cassettes. His entire music collection is recorded on cassettes and he has always preferred using the Walkman over switching to a portable CD player or any other contraption. That his friends all make fun of him for sticking with his old cassette-playing companion, while they have all upgraded their devices, makes little difference to him. He knows what he likes.

Now, what kind of consumer is John? There is wide agreement in the literature that Innovators are first to adopt a new product, and conversely that Laggards are last to adopt. Based on the description above, is John likely to be a Laggard? His preference for an antiquated product and his unwillingness, and even resistance, to upgrade would appear to make him one. Indeed, Laggards are often described as localities and traditionalists [1]. However, do such behavioral inclinations to resist necessarily correspond with late adoption? In this paper we argue that they do not. We propose that some dispositional resisters may exhibit a tendency to skip generations, or in other words, to *leapfrog*. Contrary to what their behavioral tendencies seem to imply, dispositional resisters may often show up as Innovators on product adoption curves, rather than Laggards.

Diffusion models generally look at each product as distinct and as independent of other products, and assume that, over time, all members of that potential market will eventually either adopt or decide not to adopt and will not constitute part of the market. However, this is often not the case. In many cases, products evolve in a form of successive product generations that satisfy the same need but through an entirely different technology, each of which can be considered a new product in itself. Music players that came out after the Walkman are a good example: although completely different from the Walkman in the way they are used, in their technology, and in their quality, CD players and Mp3 players address the same

fundamental need of listening to music “on the move” (e.g., walking jogging or traveling). In these cases, adoption curves are often incomplete, and encompass much less than the entire market.

Imagine now that, recently, John has finally realized that the sound generated by his Walkman is indeed much poorer than that produced by all of his friends’ players, and that it is also much bulkier and heavier. Apparently, after all these years, even John acknowledges that it is time to buy something new. In fact, we could even consider the possibility that John’s Walkman simply broke down. At any rate, the question is: what kind of player is John going to buy? Will he buy a portable CD player? Or, maybe a Mini-Disc? If John decides to skip a generation or two, perhaps he will go all the way and choose the Mp3 player? In this case, would it be a surprise if John simply bought the most recent version of the iPod?

Assume that after discussing the issue with his friends, John decides to buy the most technologically-advanced player. An examination of John’s time of purchase, as it appears on the Mp3’s adoption curve, would identify John as a classic Innovator, among the first to purchase the new product. Generation skipping may make John an Innovator, based on his position on the product’s life cycle curve, despite his dispositional tendency to resist innovations.

Like John, almost all resistors come to a point where they ultimately upgrade their products. What makes them resistors is not that they never upgrade, but that they upgrade *less frequently* than others. One question is how far will they upgrade? Although the newest products may often be more expensive than mid-range ones, the more substantial switching costs for John are likely to involve the adaptation to the new technology. For John, upgrading would mean abandoning the hundreds of cassettes he has accumulated over the years and purchasing new CDs or the rights to download music to his Mp3 player. In this respect, it should make little difference to him whether he switches to a portable CD player or to the Mp3.

Therefore, even though resistors take much longer to upgrade than other consumers, once they upgrade they may very well upgrade to the latest technology available. Contrary to other consumers, however, resistors have held on to their old products long enough for newer generations of products to join the market. Thus, when resistors upgrade they will often need to skip several generations in order to reach the most recent technologies. We call this phenomenon the *consumer leapfrogging effect*.

When products do not involve generations, resistors are always among the last to adopt, which by definition, makes them Laggards. For these products, then, the terms Laggard and resistor can be used interchangeably. However, when an industry’s products involve several generations (e.g., Walkmans, portable CD players, Mini-Discs, etc.), the behavioral and dispositional sources of lagging do not necessarily converge. Contrary to the accepted definition of Laggards — as those who are last to purchase the product — it may be more appropriate to define them, in these contexts, as those who hold on to their products longest and who are the last to *switch*.

Lagging therefore appears to constitute the surface-level, behavioral, manifestation of consumers’ inherent resistance to new products. Research on the concept of resistance to change has uncovered individual differences in people’s inherent inclination to resist changes and new ideas and products [9]. In other words, some people are more likely than others to resist or avoid trying out new things. Such inclinations fall in line with the overall profile of the typical Laggard. When a new product is introduced, dispositional resistance manifests itself in late adoption. Indeed, resistance to change has been found to correlate with time of adoption across a variety of products such as cordless phones, VCRs, and software packages [9,10]. However, when multi-generation products are involved, the ultimate kind of lagging can be exhibited in a certain generation being skipped altogether. As in John’s case, skipping generations can coincide with the early adoption of other generations. Thus, whereas the underlying tendency to resist

Table 1  
Portable audio player ownership

	Portable cassette player	Portable CD player	Mini-Disc	Mp3 player
Percent of participants who have owned product	67	48	14	30
Mean year of adoption (SDs in parentheses)	1995.5 (5.4)	2000.1 (3.9)	2000.9 (1.7)	2003.7 (1.3)

remains the same, the nature of the product involved (i.e., single vs. multiple generations) determines how resistance will be manifested in lagging, or in leapfrogging, which creates the potential for early adoption.

### 3. The prevalence of leapfrogging

Certainly not everyone is like John. Some people like to upgrade their products frequently (some of whom probably belong to the typical Innovator population), others may be reluctant to abandon their current product, but would still not like to stay behind. So, how prevalent is the leapfrogging phenomenon? To provide an initial examination of this phenomenon, we sampled 105 individuals (66% men and 34% women) between the ages of 26 and 60 and asked them about their inventory of portable audio players. Participants were asked whether they owned and when they purchased a portable cassette player, a portable CD player, a Mini-Disc and an Mp3 player. Ownership percentages and means and standard deviations of adoption years are presented in Table 1.

The distribution of the distance of the leap is presented in Fig. 1. Of those who owned a portable cassette player, 61% moved on to adopt a portable CD player, 6% skipped the CD player and moved on to buy a Mini-Disc, 10% leapfrogged over both the CD player and the Mini-Disc and bought an Mp3 player, and another 23% have not yet purchased any portable player after the cassette player. Therefore, a total of 16% of those who owned a portable cassette player leapfrogged, with another 23% who are likely to leap, maybe even beyond the Mp3 player.

Almost by definition, the longer individuals hold on to their products, the greater is their leap likely to be. As in John’s case, by the time a resistor decides to switch, the most prevalent and accessible product around is likely to be several generations beyond the initial product owned. Accordingly, in our sample

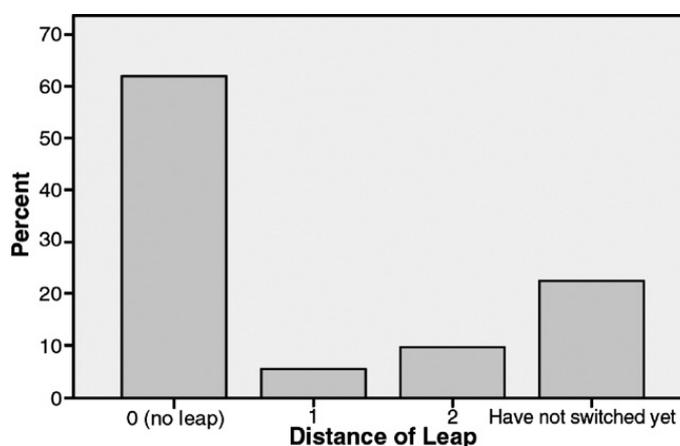


Fig. 1. The leap distance distribution.

there was a significant correlation ( $r=0.36$ ,  $p<0.05$ ) between the amount of years participants held on to their portable cassette player and the distance of their leap (i.e., the number of products that participants' skipped).<sup>2</sup> While the 10% who leaped from the Walkman to the Mp3 player have held on to their cassette player for quite some time, and could have likely been chastised by their less resistant friends for not owning a portable CD player, in leaping they progressed beyond the majority of consumers in the market and have therefore become Laggards in an innovator's disguise. In fact, in our sample 22% of those who reported owning an Mp3 have leaped from the portable cassette player to the Mp3 player (i.e., skipped the portable CD player and the Mini-Disc).

Our purpose in this study was to gain a preliminary sense of the prevalence of the consumer leapfrogging effect. Considering our sample size it is likely only a coincidence that both the proportion of leapfroggers in our sample and Rogers' [1] assessment of the proportion of Laggards in the population are 16%. Other estimations suggest that laggards may actually constitute 21% of the market [3]. If we accept the contention that lagging and leapfrogging stem from similar sources (i.e., resistance to the adoption of new products) and that therefore many individuals who are dispositionally disinclined to switch might turn out to be Innovators (as far as their time of adoption of a new-generation product is concerned) it is interesting to try and evaluate their economical value to the firm.

#### 4. Assessing the value of leapfrogging

Why is the leapfrogging effect meaningful from a firm's perspective? How does the fact that someone who is late to switch from a previous product then becomes the Innovator of a new one, impact sales? In the case of John, who decided to adopt the Mp3, the direct effect of his purchase on company sales derives from the simple fact that one more person has purchased the product. The size of this effect is obviously negligible. However, it has been shown in a different case, with similar dynamics (i.e., the value of a lost customer), that the *indirect effect*, created by an *internal force* of the word-of-mouth that consumers spread, is much more substantial [11]. When John used his Walkman, his word-of-mouth about the product was insignificant, because all around people had already possessed some kind of portable player, probably better and more advanced than his own. On the other hand, when John shows up with his new Mp3 player, his word-of-mouth will now count as that of an Innovator. This effect may be even larger than that of a more typical Innovator because *his* adoption signals that anyone (even a resistor such as himself) can purchase and use the new product. For simplicity's sake we will adopt a conservative approach and assume that John's influence on other potential adopters is the same as that of any other consumer.

Nevertheless, as time passes by, and the resistor has not yet leapfrogged, generations of products are overlooked and will likely never be adopted by this resistor. If people like John, who still holds on to his Walkman, decided to leapfrog today, that would make the Mp3 a likely candidate for their new purchase. However, were they to hold on to their Walkman a little longer, they might as well skip even the Mp3 and end up purchasing a newer-generation product. For each product, a resistant population exists that will potentially skip, and thus never purchase, that product.

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<sup>2</sup> For the analysis, the conservative assumption was made that those who have not yet switched products since owning a portable cassette player will switch within the next year. It was also assumed that these late switchers will, on average, leap to the Mp3 player. Certainly it is possible that some will switch to earlier generations, yet these are likely to be outnumbered substantially by those who will leap even beyond the Mp3.

The potential gain in addressing these resistors comes from firms' potential to convince them to leapfrog earlier than they would have naturally. In other words, if Apple were to somehow convince John, and his like, to abandon their Walkmans today, instead of waiting for the next product, they would benefit from both the direct and indirect effects on iPod sales. Otherwise, they would be certain to miss out on these benefits at this point in time, and would likely miss out on them entirely in the case that these consumers end up adopting a next-generation product, manufactured by another firm. It would be interesting, then, to quantify the indirect effect created by resistors' leapfrogging in order to evaluate the value of pursuing this population.

As noted earlier, when a resistor leapfrogs, the firm's profits increase for two distinct reasons. The direct profit comes from the fact that an early purchase takes place, which leads to an increase in the firm's Net Present Value (NPV). This, however, is likely a small effect because this constitutes only one additional adoption. On the other hand, research suggests that the indirect effect created through leapfrogging is likely to be much stronger. Hogan et al. [11] modeled the influence of a lost (disappointed) customer who spreads negative word-of-mouth, causing other customers to switch to a competitor's service, and found it to be much more substantial than the direct effect.

Similarly, the impact of the indirect effect of an early-adopting resistor should also be substantial, except that in the resistor's case the word-of-mouth will be positive (assuming that the resistor is satisfied with the new product). As mentioned above, late adopters have very few potential adopters around them, so their internal (i.e., word-of-mouth) effect is negligible. However, when resistors leapfrog, they find themselves surrounded by potential adopters that can be influenced. The visibility of the new product thus increases. In such a case, leapfrogging may prove to accelerate the adoption process.

Following this rationale, the model employs two parts: The first (Eq. (1)), calculates the extent to which a product has been adopted over time, given the market size, the impact of the firms' marketing effort, and the influence of customers' word-of-mouth. This equation is based on the Bass model [12], and it calculates the cumulated product adoption through a simple adoption model: where  $N(t)$  is the cumulative number of adopters. The number of annual adopters (usually denoted as  $n(t)$ , but we do not use this notation here) is also a time-dependent number and it is the derivative of  $N(t)$ .  $M$  represents the market size,  $p$  is the probability that an individual within the market will adopt in light of the firm's marketing efforts (i.e., the external force), and  $q$  is the probability that an individual will adopt in response to word-of-mouth (i.e., the internal force). In this model both  $p$  and  $q$  are assumed to be equal across population and across time.

$$\frac{dN(t)}{dt} = \left( p + q \frac{N(t)}{M} \right) \cdot (M - N(t)) \quad (1)$$

The second (Eq. (2)), uses the result from the first equation to calculate the expected profit due to the indirect effect created by the word-of-mouth. Here we use a simpler version of the equations to meet the particular context of our study.

$$\text{NPV}(t_0, t) = \int_{s=t_0}^t \frac{dN(s)}{ds} e^{-d(s-t_0)} \quad (2)$$

We are interested in what happens to the product's adoption curve once a small subgroup of resistors leapfrogs and becomes among the first to adopt the new product at hand. For simplicity, let us assume that

leapfrogging occurs in the course of the first year following a product’s launch, and does not persist in the following years. Accordingly,  $N(t=1)$  increases by the number of resistors who leapfrogged. For any given diffusion process,  $p$  and  $q$  can be derived, and thus  $N(t)$  can be calculated. As a next step,  $N(t)$  can be substituted into Eq. (2). Both calculations in Eqs. (1) and (2) are performed in their discrete form (see Ref. [11]), in which we use Eq. (3) for calculating the Net Present Value.

$$NPV[t_0, t] = \sum_{t=t_0}^t \frac{dN(t)/dt \cdot K}{(1 + d)^{t-t_0}} \tag{3}$$

$K$  represents the profit a firm makes from a single adopter (which in our case is fixed to  $K=1$ );  $d$ , typically called the *discount rate*, represents the expected annual interest rate a firm is likely to obtain on  $K$  (fixed here to be 10%).  $t$  is now a discrete variable representing the period number,  $t_0$  represents the time of a product’s launch and  $dN(t)/dt$  is now a discrete variable, which has been calculated through the numerical form of Eq. (1), represents the number of adopters in time  $t$ . Thus, the NPV can be calculated.

In this study, we will use this model to compare a regular diffusion process to one that includes an additional subgroup of leapfrogging resistors. We will examine the situation in which 1% of those resistors (assumed to constitute 0.16% of the market, based on the proposed proportion of Laggards in the market), who would have otherwise leapfrogged over, and skipped, the product, were somehow convinced to leapfrog earlier and become its Innovators. In order to test the model under realistic conditions, and learn about the economic value of leapfrogging, we will run a meta-analysis through a regression analysis of 54 known cases of products that have already completed their adoption process, with known  $p$ ,  $q$  and  $M$  (external and internal forces and market size) coefficients.

### 5. Results

Fig. 2 illustrates the acceleration process involved in leapfrogging. A representative diffusion process with  $p=0.03$  and  $q=0.3$ , and  $M=90,000$  units has been set up. As a next step, a leapfrogging effect of 1%

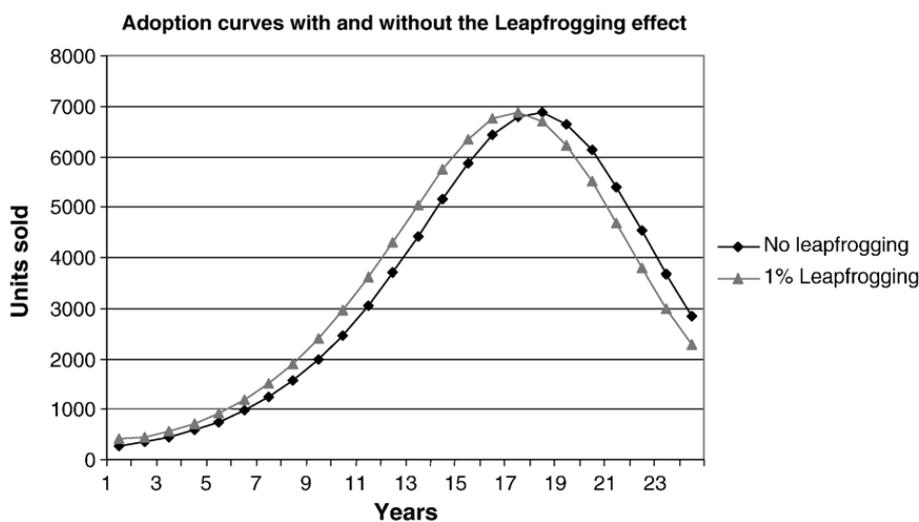


Fig. 2. Speeding up the adoption process by leapfrogging. The gray line denotes a hypothetical curve that reflects product adoption if 1% of Laggards were persuaded to leapfrog. It was assumed that the Laggard population comprises 16% of the market.

of the resistors is assumed. As a result, the adoption curve shifts left (the new curve is denoted by a gray line), as expected, which indicates that the overall product adoption process has accelerated. The NPV of the process increases by 9.2%. Although it is not clear how easy it would be to encourage 1% of the resistors to leapfrog, we consider 1% a conservative estimate.

In order to quantify this effect further, we examined 54 real adoption processes of products that were all selected for being clear cases of innovation and have already completed their diffusion processes. The coefficients of a diffusion model (Bass) for each process were obtained from Lilien et al. [13, p. 300]. Accordingly, we consider the selected data are representative of important innovations in general. The innovations included main categories of agricultural innovations (e.g., tractors), medical equipment (e.g., ultrasound imaging devices), production technology (e.g., an oxygen steel furnace), electrical appliances (e.g., air conditioners), and consumer electronics (e.g., camcorders).

For each process, we computed two “what if” scenarios in which 1% or 10% of resistors decided to leapfrog to the product at hand. Because each of the different innovations was introduced at a different time, and because not all data sets covered the diffusion process through to its end, we used the diffusion coefficients ( $p$ ,  $q$ , and  $M$ ), provided by Lilien et al., to estimate the entire process, only in the years covered by the data.

To be conservative, we considered resistors to comprise 16% of the population. The calculations of the NPV, with and without leapfrogging, showed that in the case that 1% (of resistors) leapfrogged, firms would have increased their profits by 14% on average. In the case that 10% of resistors leapfrogged, the average profits would have increased by up to 89% on average.

To better understand the leapfrogging effect, we performed a linear regression analysis with the NPV ratio as the dependent variable. NPV ratio is calculated in the following way: (NPV with leapfrogging – NPV without)/NPV without.

Independent variables were the internal and external diffusion coefficients (calculated through the Bass model denoted by  $p$  and  $q$ ), the market potential ( $M$ ), and a dummy variable representing the two proportions of accelerated leapfroggers (1 or 10%). Because non-linear effects were expected, the interactions between  $p$  and  $q$  with leapfrogging proportions were added (see Ref. [14] for the procedure). In addition, square terms of  $p$  and  $q$  were added as additional independent variables. The results of the analysis are presented in Table 2. Coefficients are standardized; the adjusted  $R^2$  was 0.41.

Not surprisingly, the market potential had no effect on the NPV ratio as a result of leapfrogging. It is interesting to note, however, the strong non-linear effects of the diffusion coefficient, as can be learned

Table 2

Regression analysis: dependent variable is NPV ratio, all coefficients are standardized,  $p$ ,  $q$  and leapfrogging proportions are centered

Parameter	Standardized coefficient	Significance
Leapfrog size	0.23	0.00
$p$	–0.65	0.00
$q$	–0.11	0.30
$p^2$	0.43	0.00
$q^2$	0.45	0.00
Leapfrog size $\times$ $p$	–0.20	0.00
Leapfrog size $\times$ $q$	0.21	0.00
Market size ( $M$ )	–0.07	0.93

The adjusted  $R^2$  is 0.41.

from the different coefficient signs. As can be seen, the NPV ratio decreases with low levels of the external force ( $p$ ). In other words, in slow process regimes, (involving a long left tail before takeoff), the leapfrogging effect is more dramatic, perhaps because it becomes an alternative to marketing forces ( $p$ ) and enables the process to commence even in the case of a less effective external force. With higher  $p$ 's the marketing efforts are stronger and compete with the leapfrogging effect, thus dampening its influence. As the process accelerates, creating a shorter tail before takeoff, the main driver of adoption speed becomes the internal force. In this case, the indirect effect of leapfrogging increases. Contrary to the external force's effect, the effect of the internal force ( $q$ ) is monotonic, as can be seen by the non-significant linear term of  $q$ , along with the significant squared term (when the squared term is removed from the equation, the linear term gains significance).

It is not surprising that an increase in the leapfroggers' population size also increases the NPV. However, the results indicate two interactions in which both interaction terms exhibit effect sizes that are equivalent to the main effects. Analyzing the interactions using median splits (of  $p$  and  $q$ ) corroborated the existence of the non-linear effects. For low values of  $p$  the effect of leapfrogging is large because it competes with the external force in activating the growth process. As the process accelerates (large  $p$ 's) the leapfrogging effect decreases and there is almost no difference between high and low levels of leapfrogging (even when the size of the leapfrogging population is multiplied by 10). The significant interaction with  $q$  is also consistent with this explanation: as  $q$  increases, the influence of the leapfrogging population size increases because of the indirect effect.

This means that the leapfrogging effect is stronger when growth consists of word-of-mouth, and that if a firm identifies leapfrogging and adoption through w-o-m, it may be that less marketing expenditures are needed, if any. This observation may also suggest, and perhaps counter-intuitively, that when an innovation seems to be slow to takeoff, it may be particularly beneficial to consider shifting at least part of the marketing efforts to older-generation consumers and to try and persuade them to leapfrog, instead of targeting typical Innovators or main market consumers.

## 6. Discussion

Our findings demonstrate that leapfrogging (which happens once typical Laggards decide, for whatever reason, to replace a product and skip generations) may have an important impact on firms' revenues. As we have demonstrated, even if a small portion of such Laggards can be persuaded to leapfrog earlier than they would have by nature, firms' profits increase substantially because of the acceleration in the entire adoption process. Another interesting finding is that the leapfrogging effect increases when the external force that stands for marketing effectiveness is weak. This leads to the conclusion that in slow adoption processes in particular, it may be quite profitable to address the resistor population.

The management and marketing literatures generally suggest disregarding the segment of the consumer population that manifests strong resistance. One exception is Mahajan and Muller's [18] work that examines the benefit of starting off by targeting later segments (such as the majority). Being the polar opposites of Innovators (when one-generation products are concerned), Laggards are typically perceived as those who adopt long after the product has been first introduced. Thus, their contribution to firms' profits, at that point, is insignificant. This state of matters may be justified for some products, but certainly not for all. More precisely, some product categories involve an intrinsic process in which new generations substitute old ones [15]. For such products, the Laggard concept needs to be considered more carefully.

In our analyses above we demonstrated that if firms were to even slightly hasten leapfrogging, the impact on profits would be substantial. In reality, we believe that the indirect effect may be even stronger than we have demonstrated, because consumers who come across an early-adopting Laggard may gain even more confidence in the new product than they would have had they observed an Innovator upgrade (consistent with the view of the chasm, see Refs.[16,17]).

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