



## Management Science

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To cite this article:

Frank M. Bass, (2004) Comments on “A New Product Growth for Model Consumer Durables The Bass Model”. Management Science 50(12\_supplement):1833-1840. <https://doi.org/10.1287/mnsc.1040.0300>

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# Comments on “A New Product Growth for Model Consumer Durables”

## The Bass Model

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The paper that I authored and that was published in *Management Science* in 1969 (Bass 1969) has become widely known as the “Bass Model” (see Morrison and Raju 2004). The model of the diffusion of new products and technologies developed in the paper is one of the most widely applied models in management science. It was especially gratifying for me to learn that INFORMS members have voted the “Bass Model” paper as one of the Top 10 Most Influential Papers published in the 50-year history of *Management Science* in connection with the 50th anniversary of the journal. In this commentary on the paper I shall discuss some background and history of the development of the paper, the reasons why the model has been influential, some important extensions of the model, some examples of applications, and some examples of the frontiers of research involving the Bass Model. In the current period, in which there is much discussion about the marketing of applications of management science methods and practice, I hope that this commentary will be useful in providing insights about some of the properties of models that will be applied.

*Key words:* Bass Model; diffusion of innovations; forecasting; generations of technology

### 1. Introduction

Perhaps the first thing to notice about the paper that has come to be known as the “Bass Model” (Bass 1969) is the title. It contains a typo. The paper was published with the title: “A New Product Growth for Model Consumer Durables.” The correct title should be: “A New Product Growth Model for Consumer Durables.” I suppose that I was so excited about having the paper accepted for publication that I failed to carefully proofread the galley proofs. There is a more important defect in the title, however. The title suggests that applications of the model in the paper would be limited to consumer durables. However, applications of the model have been shown to apply to a much wider class of products and services and it has become especially significant in forecasting B2B products and services of many categories including telecom services and equipment, component products such as semiconductor chips, medical products, and many other technology-based products and services.

There have been hundreds of applications of the Bass Model and, judging from the e-mails and telephone calls that I receive, the number of applications has been accelerating in recent years. The 1969 Bass Model paper has spawned the development of a core group of academic researchers in diffusion theory that is growing in number and influence. The model is a central component of models that lie on the

frontier of diffusion research including such topics as multicultural diffusion, models of successive generations of technology diffusion, relationships of diffusion between different product categories, estimation methodology for nonlinear models, and models of the adoption at the individual level. The 1969 Bass Model paper is one of the most highly cited papers in the marketing literature. In many MBA programs (and even in some undergraduate classes in marketing) the Bass Model is included in the list of core topics to be covered.

It is clear, I think, that the Bass Model has been very influential in the real world of applications and in the theoretical world of basic research. In this commentary I shall discuss some background and history of the development of the paper, the reasons why the model has been influential, some important extensions of the model, some examples of applications, and some examples of the frontiers of research involving the Bass Model. It is my hope that the discussion here will be useful in suggesting properties of management science models that will be influential in practice and theory.

### 2. Background and History

In the early 1960s when I was a professor in the Krannert School at Purdue University I began reading Everett Roger’s book (Rogers 1962) on the diffusion of innovations. In this classic work Rogers classifies

adopters of an innovation according to the timing of their adoption. A normal distribution is specified for the timing of adoption, and five classes of adopters are specified: (1) Innovators; (2) Early Adopters; (3) Early Majority; (4) Late Majority; and (5) Laggards. According to the theory, apart from innovators (defined as the first two and one-half percent of the adopters), adopters are influenced in the timing of adoption by the pressures of the social system, the pressure increasing for later adopters with the number of previous adopters. Apart from innovators, then, adopters could be said to be influenced by *imitation* in varying degrees. I decided to try and put some mathematics to these ideas and I came up with a conditional likelihood of adoption (now called a hazard function) in which the conditional likelihood of adoption at time  $t$  was a linear function of the number of previous adoptions. The intercept of the likelihood was called the “coefficient of innovation” because it did not interact with the cumulative adopter function, and the coefficient that was multiplied times the cumulative function was called “the coefficient of imitation” because it reflected the influence of previous adopters on the conditional likelihood of adoption. Manipulation of the likelihood function to obtain the unconditional likelihood of adoption at time  $t$  on the left-hand side and multiplying through by a parameter for the ultimate number of adopters one obtains a nonlinear differential equation. Fortunately, there exists a closed-form solution to the differential equation in the time domain. If the coefficient of imitation is greater than the coefficient of innovation the solution rises to a peak and then declines. I immediately recognized the beauty of this result, but I was somewhat skeptical of the ability of the model to match well with empirical data. I was working on a number of other research projects at the time and I put this work aside intending to later attempt to obtain data to compare with the theoretical results. I did, however, include the theoretical development of the Bass Model among some other marketing models in a 1963 paper (Bass 1963).

Upon returning from England after a year there as a visiting professor in 1966 I resumed work on the Bass Model paper. Data for 11 consumer durable product sales were obtained for the early years of sales. Somewhat to my surprise the model described the data rather well in every case. The notion that the pattern that the model predicted was an *empirical generalization* began to form in my mind. The fact that a peak in sales always existed and the notion that it might be possible to forecast this strategically important event began to take hold. I decided to try my luck at forecasting color television sales, which had just begun to take off in the early 1960s. Sales data were available only for three years: 1964, 1965, and part of 1966. Clearly, an estimate for a model with

three parameters and three observations would not be reliable. Undaunted, I developed a method for transforming the unreliable parameter estimates into what seemed to be plausible estimates. The result was a forecast that color television sales would peak in 1968 at 6.7 million units. A working paper was produced in 1966 (Bass 1966) that contained the theoretical development, the empirical analysis of the 11 consumer durables, and the forecast of color television sales. The 1969 paper published in *Management Science* was very little changed from the 1966 working paper. The 1966 working paper received rather wide circulation and resulted in several letters and telephone calls to me from industry people and Wall Street analysts, many of which took a rather angry tone. Industry forecasts were much more optimistic than mine and it was perhaps to be expected that my forecast would not be well received. As it turned out, color television sales did peak in 1968 and at a slightly lower level than my forecast. The industry had built capacity for 14 million color picture tubes and there was substantial economic dislocation following the sharp downturn in sales following the 1968 peak. This is a story that has been repeated many times. As sales of a new product begin to grow exponentially the industry becomes unrealistically optimistic and extrapolates sales growth into the hereafter, failing to take into account saturation effects. My point here is that the Bass Model provides a useful framework for viewing the diffusion of new products and technologies so as to permit realistic guesses about the pattern of sales growth and the timing of the peak in sales.

### 3. Why the Bass Model Has Been Influential

Models are abstractions and simplifications of reality. Useful models capture the essence of reality in a way that enhances understanding of phenomena. Simple and elegant mathematical models, often referred to as “beautiful,” that match well with the phenomenon being studied will have appeal in the arena of competing ideas about the phenomenon. The appeal of such models is further enhanced if the parameters have intuitive interpretations. I believe that the Bass Model has the properties just discussed. Models that have these properties will tend to lead to modifications, extensions, and applications built around customized adaptation to suit particular circumstances and individual preferences. Also, consistent with the development of science, models that explain phenomena tend to lead to “higher-level theories” that match the phenomena but also predict or explain other things (see Bass 1995 for a discussion of a higher-level theory involving the Bass Model).

Although the 1969 paper used the term “imitation” to describe the interactive portion of the adoption

process others have used terms such as “word of mouth,” learning, contagion, interpersonal communication, and internal influence. These various depictions reflect, I think, the wide intuitive appeal of the model as adapted to suit personalized interpretation. The fact that parameters of the model allow for intuitive interpretation facilitates “guessing without data.” The most important use of the model for forecasting purposes is the forecast made prior to product launch when there are no sales data upon which to base the forecast. Rather large databases of parameter estimates of the Bass Model parameters for different products and services have been developed and these have lead to meta-analyses of empirical studies using the Bass Model (see Sultan et al. 1990 and Farley et al. 1995). The Bass Model pattern of adoption over time is an empirical generalization (see Mahajan et al. 1995) and, although the general pattern of sales growth to a peak and then decline is expected, there remains uncertainty about the speed of growth and decline. However, the existence of data of sales histories of previously introduced products and services suggests the approach of “guessing by analogy” by which the  $p$  and  $q$  parameters for the new product are determined by a guess as to which product or products in the database are likely to be most similar to the new product in diffusion pattern features. The market potential parameter may be guessed on the basis of known market characteristics and perhaps supplemented by intentions data from surveys.

The cumulative version of the Bass Model is an S-shaped curve. There are many S-shaped curves, of course, and these curves have been used extensively to describe and forecast a large variety of growth phenomena. Unlike other growth models the Bass Model was derived from a basic premise about diffusion and, as a consequence, the parameters have intuitive interpretations in a diffusion context. In addition, in most contexts the focus of the “Bass Curve” is the unconditional likelihood of purchase at time  $t$  rather than the cumulative distribution. As a consequence, attention is centered on the pattern of adoption (or sales) of a peak and decline which, in most cases, is the primary pattern of interest to managers.

In summary, the Bass Model paper has been influential because it contains a simple, elegant theory that predicts and explains the existence of an empirical generalization and because the underlying premise of the theory has an intuitive appeal and the resulting parameters have intuitive interpretations.

## 4. Some Extensions

The literature in marketing on the diffusion of innovations has grown to a substantial size and continues to expand. Most of this literature involves developments that are extensions of the Bass Model. It is far beyond the scope of this brief commentary to discuss

extensions comprehensively, but a good source for interested readers is the book *New-Product Diffusion Models* edited by Mahajan, Muller, and Wind (2000). Here I do want to discuss two important extensions of the Bass Model that have been shown to be appropriate for many applications and especially so for high-technology products. The first of these is an extension that applies to the diffusion of successive generations of technology, and the second is a generalization of the Bass Model that permits the inclusion of decision variables such as price and advertising in the model in such a way that the basic shape of the diffusion curve is maintained.

### 4.1. Diffusion of Successive Generations of Technology

Technological products come in generations. A new generation represents an improvement over the earlier generations so that buyers of earlier generations flow over time to the latest generation and the market expands as uses and applications grow as the technology improves. With the emergence of digital technologies and the growth in products that evolve rapidly in successive generations, the importance of generational diffusion models has grown. The first generational diffusion model of sales was published by Norton and Bass (1987) in *Management Science*. This model is an extension of the Bass Model and the underlying diffusion process in the model stems from the Bass Model.

The theoretical system of equations of the Norton-Bass model for sales of products with continuous repeat purchasing is presented for three generations, for simplicity, as

$$\begin{aligned} S_{1,t} &= F(t_1)m_1[1 - F(t_2)], \\ S_{2,t} &= F(t_2)[m_2 + F(t_1)m_1][1 - F(t_3)], \\ S_{3,t} &= \{m_3 + F(t_2)[m_2 + F(t_1)m_1]\}, \end{aligned} \quad (1)$$

where

$m_i = a_i M_i$  and  $M_i$  is the *incremental* number of ultimate adopters of the  $i$ th generation product (assuming that there are no further generations);

$a_i$  is the average (continuous) repeat buying rate among adopters of the  $i$ th generation product;

$t_i$  is the time since the introduction of the  $i$ th generation product; and

$$F(t_i) = \frac{[1 - e^{-(p+q)t_i}]}{[1 + (q/p)e^{-(p+q)t_i}]}.$$

The last equation above is the cumulative distribution representation of the Bass Model and in this version of the Norton-Bass model the  $ps$  and  $qs$  are assumed to be the same for each generation so that the  $F$  functions are without subscripts. In the more general version of the model  $ps$  and  $qs$  can be permitted to vary by generation. Experience in fitting the

model to a substantial number of generational products and services (see Norton and Bass 1992) indicates that in most cases, remarkably, the fit of the model to the data is not greatly improved when the  $ps$  and  $qs$  are allowed to vary by generation. This is not always true, however, and there are instances where diffusion rates vary substantially from one generation to the next.

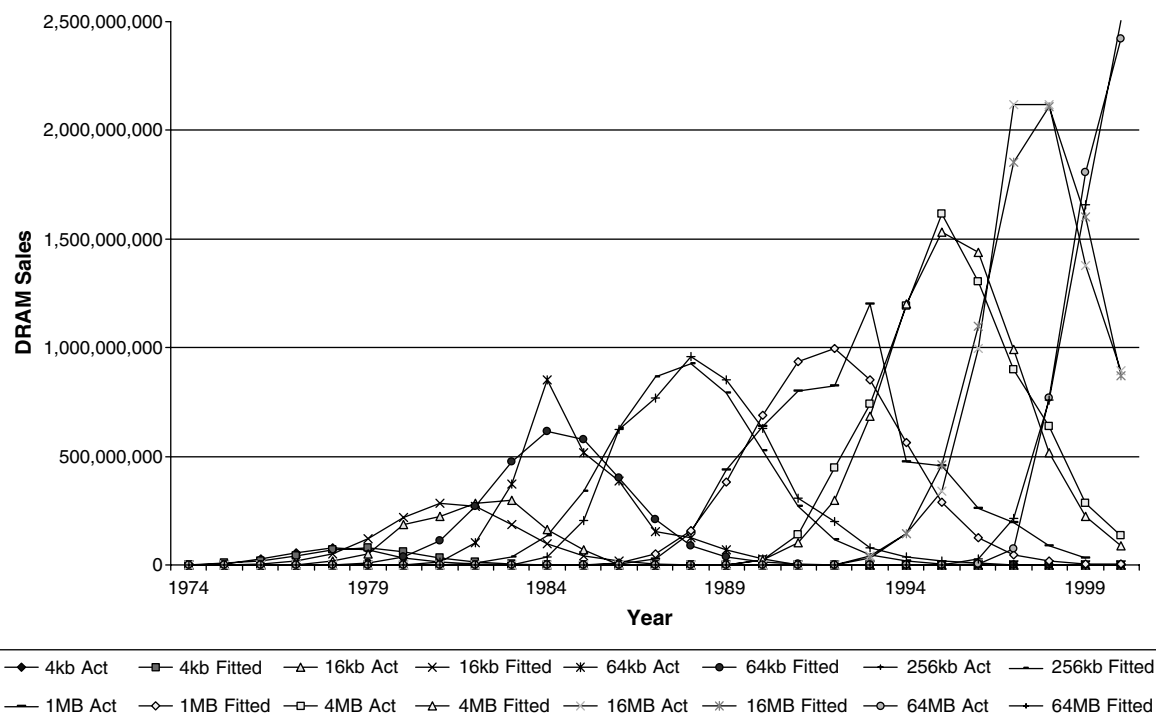
The system of equations for three generations indicated in (1) can be extended to any number of generations and the model has been estimated for many different product categories. In the system of equations sales of generation one at time  $t$  are a function of  $m_1$  before generation two arrives, then are a function of  $m_1$  minus what the second steals. Sales of generation two at time  $t$  are a function of  $m_2$  and  $m_1$  before generation three arrives, then are a function of  $m_2$  plus  $m_1$  minus what the third steals. Sales of generation three are a function of  $m_3$ ,  $m_2$ , and  $m_1$  until the fourth generation enters, and so on. Because the underlying adoption process is specified as the Bass Model a diffusion process governs adoption timing.

The pattern of sales described by the system of equations is generally one of migration and growth. The market flows from earlier generations to later generations and each new generation expands the market. Shown in Figure 1 are the sales of eight generations of DRAM chips ranging from the 4kb chip in 1974 to the 64MB chip in 2000, and the fitted Norton-Bass model of sales of each chip where the fitted sales have been developed under the assumption that the

$ps$  and  $qs$  are the same for each generation. Taking into account that the estimation process involves eight simultaneous highly nonlinear equations, the results as indicated in Figure 1, are quite remarkable. In those categories where the  $ps$  and  $qs$  are the same for each generation forecasting of later generation sales are facilitated. Estimates of  $ps$  and  $qs$  from early generations imply that forecasts of later generation sales will require only information about introduction times and guesses about the  $ms$  for forecasts of the later generations sales.

The pattern of generational sales shown in Figure 1 has been shown to apply to many product categories with varying characteristics and it can be regarded as an empirical generalization. Although the Norton-Bass model was designed to apply to product categories where there is continuous repeat purchasing by adopters such as DRAM, Disk Drives, Recording Media (vinyl, tapes, CD's), Diapers (cloth and disposable), and Drill Bits it has also been shown to provide good fits in other circumstances such as where there is adoption and continuous use of the product. Examples of the latter type include subscribers to successive generations of wireless telephones and adopters of successive generations of mainframe computers. In these cases the parameters and variables require reinterpretation and new definitions. The number of applications of the Norton-Bass model is growing, and theoretical and empirical developments around the model are also proceeding.

**Figure 1** Norton Bass Model Eight Generations of DRAM Chips Actual and Fitted 1974–2000 Same  $ps$  and  $qs$  (Data from Gartner Dataquest)



## 4.2. Decision Variables in Diffusion Models

It is well known that changes in prices and other decision variables will influence the diffusion process (demand). From a managerial perspective it is highly desirable to have a model that can provide a basis for assessing the effects of decision variables on the diffusion process. Indeed, one of the early applications of the Bass Model was a study at RCA in which the Bass Model was modified to include price in order to explore optimal pricing policies for new products. This work is described in a paper published in *Management Science* (Robinson and Lakhani 1975). The model suggested by Robinson and Lakhani was used in several other papers that examined optimal pricing policies associated with the diffusion of new products. Over time other modifications of the Bass Model were developed that included decision variables, including one by Bass (1980). In the early 1990s in connection with the issue of how decision variables should be included in diffusion models, I began thinking about the following question: Why do we always observe the “Bass Curve” of sales of new products rising to a peak and then declining? We know that there are wide variations in pricing and other decision variable policies over the many new products yet all the sales curves are “Bass Curves.” This led me to conclude that decision variables should be included in the diffusion model in such a way that, under ordinary circumstances, the shape of the curve would be maintained. Also, at the suggestion of a manager with whom I was consulting about new product introduction strategy, I began thinking about policies that would “shift the curve.” In collaboration with Trichy Krishnan and Dipak Jain, a “Generalized Bass Model” was developed (Bass et al. 1994). The Generalized Bass Model is a “higher-level theory” in that it reduces (approximately) to the Bass Model under ordinary conditions for the decision variables. This model has proven to be quite useful for managerial purposes in that it can be used to study policies that will “shift the curve.” The model maintains the fundamental “carry-through” effects of the Bass Model and it has empirical support for cases where price and advertising data are decision variables. Most importantly, it explains why the Bass Model fits the data without including decision variables, an explanation that is lacking in the other diffusion models that include decision variables.

## 5. Some Applications

As mentioned earlier there have been hundreds of applications of the Bass Model. My own recent experience with applications of the model and extensions of it prior to product launch include satellite television, satellite telephone, satellite radio, a new LCD

projector, a new medical technology product, wireless telephones, and wireless Internet phones (3G). Here I will briefly discuss the highlights of the methodology and outcomes of two of these projects.

In 1992 DIRECTV was planning the launch of a satellite television system when I became involved in the planning and forecasting project. The product was launched in 1994. The details of a case history of this project were published in *Interfaces* in 2001 (Bass et al. 2001). The market potential parameter was to be estimated on the basis of a survey of stated intentions by consumers. Because the product was unknown to consumers at that time, a color brochure describing the product was mailed to a sample of consumers who had agreed to participate. The participants were later called and stated intentions to subscribe and other data were collected. The average stated probability to acquire satellite television in the survey was 0.32. It is well known that stated intentions substantially overstate actual behavior and hence it was necessary to apply a discount factor to the average stated probability of acquiring satellite television. Little is known about the appropriate discount factor to apply to stated intentions although knowledge about this is growing with experience in matching stated intentions to behavior. In the satellite television forecast a discount factor of 0.5 was used so that the estimate of the market potential was 16% of television homes. To determine the  $p$  and  $q$  parameters, the method of “guessing by analogy” was used. Among previously introduced new products two candidates were presented to management for a judgment about the likely diffusion pattern: diffusion-like color television and diffusion-like cable television in the early 1980s. Cable television was a close competitor to satellite television, and like satellite it was a subscription service. Cable television was chosen as the appropriate analogy for the diffusion pattern. Necessary conditions for successful launch and growth were specified such as strong marketing support and good distribution and a forecast of subscribers was developed for the five-year period between 1994 and 1999 using the cumulative version of the Bass Model. The forecast was remarkably good. The 1992 forecast of satellite television subscribers in 1999 was 9.4 million and the actual turned out to be 9.9 million. There is substantial uncertainty associated with any new product launch and although the methodology outlined here for satellite television does not guarantee a good forecast in every case, it is, I think, an approach worth considering.

The second application example I will discuss is for planning associated with the launch of the wireless Internet telephone, often referred to in the industry as 3G because it is the third-generation wireless telephone, following analog and digital phones. Because

there will be substantial investment in changing out the network for 3G service it appears very likely that the price of 3G service will need to be substantially greater than for the earlier-generation “voice-only” service. Therefore, it seemed to me that it was important to include the price differential as a variable in the model for planning and for forecasting. It is clear that a generational model is called for in this case and thus I developed a modification of the Norton-Bass model that incorporated the Generalized Bass Model into the Norton-Bass model. There exists some empirical data on ranges of baseline  $ps$  and  $qs$  from earlier generations and there is a bit of empirical information about price elasticities. Using this information a spreadsheet model was created that permitted the exploration of the sensitivity of diffusion of 3G to various price differentials. The results indicated that diffusion will be extremely sensitive to the price differential. Graphical demonstration of curve shifting associated with price differentials served to focus attention on the importance of price in the planning process. This example illustrates the usefulness of diffusion models as planning tools as well as forecasting tools.

## 6. Some Frontiers of Research Involving Diffusion Models

Theoretical and empirical research in the diffusion of new products, services, and technologies continues to grow. Much of this work is being done by a growing collection of diffusion researchers in the marketing science community. Some of the emerging research streams on the frontier will be briefly mentioned here.

The vast majority of theoretical diffusion models has been at the aggregate level, but recent theoretical work has emerged at the individual level that promises to produce useful insights about the nature of individual interactions in the diffusion process. Recent papers by Goldenberg et al. (2001, 2002, 2004) demonstrate the power of cellular automata simulations of Bass Model-like individual-level interactions to enhance understanding of aggregate behavior. In addition to this work, Niu (2002) has developed a Stochastic Bass Model (SBM). The model is formulated as a pure birth stochastic process at the individual level and Niu demonstrates analytically that with an appropriately chosen set of birth rates, the fractions of individuals who have adopted by time  $t$  in a family of SBMs, indexed by the size of the target population, converge in probability to the deterministic fraction of adopters in a corresponding Bass Model when the population size approaches infinity. Like the cellular automata simulations this analytical development shows promise of enhancing understanding of the relationship between stochastic individual behavior and aggregate behavior.

The Bass Model is formulated to describe the diffusion of category demand and although this is a matter of substantial interest to management, there is also great interest in brand-level diffusion. A recent paper by Krishnan et al. (2000) uses a modified Bass Model to demonstrate successful empirical modeling of diffusion at the brand level. Brand-level diffusion modeling is an under-researched area that cries out for additional attention.

The most important forecast that is made for new products is that which is made prior to product launch when no sales data are available. As indicated in the DIRECTV application discussed earlier there have been very good forecasts using the Bass Model framework for forecasting prior to product launch. Still, there are two areas that require further research. The first is in quantifying a potential market and in particular the use of stated intentions survey data. The second is in the use of analogies for parameters  $p$  and  $q$  and the availability of consistent parameter databases. I will discuss each of these in turn.

The market potential for the new product may be determined by informed judgment about the market supplemented by survey data of stated intentions. There have been a few studies of the relationship between stated intention and actual behavior in a diffusion of new products context including papers by Morrison (1979), Kalwani and Silk (1982), Jamieson and Bass (1989), and a more recent paper by Bemmaor (1995), but the fact remains that little is known about the relationship between stated intentions and actual adoptions and even less is known about how to adjust stated intentions in individual cases to estimate market potential. In my judgment knowledge in this area can only be developed over time with the accumulation of experience in matching prelaunch stated intentions in individual cases, with all of the conditions surrounding the product and the market, with actual outcomes. This will take time, but I am confident that it will happen. In the meantime, it is comforting to know that managers tend to have confidence in their ability to make realistic judgments about the market potential for new products. On the other hand, when the motivation for the new product forecast is to obtain investment funding for the new venture there is a natural tendency for judgments to be biased in the direction of overoptimism.

The other side of the “guessing algorithm” for forecasts of new product diffusion is a guess about the diffusion pattern that is determined by the  $ps$  and  $qs$ . The “guessing by analogy” method has been used with success in some cases, but it is still a guess, at best. This method depends on a database of estimates of  $ps$  and  $qs$  from previously introduced products. In some cases the historical data for the new product sales are available only some years after the product

was introduced. In this case there will be a left-hand truncation bias in the parameter estimates. Clearly, it is essential that this bias be corrected if the product is to be included in the database. In a new paper by Jiang and Bass (2004) a method is developed to correct for the left-hand truncation bias. Based on a theoretical “Virtual Bass Model” (VBM) it is proved that for any Bass diffusion process with a given start time there exists an equivalent diffusion process for any other start time. Based on this proof, if the introduction time is known, it is possible to convert the parameter estimates based on the left-truncated data to the correct parameters based on the introduction time. In addition to this feature VBM develops previously unknown mathematical properties of the Bass Model that also have potential for other uses in diffusion modeling.

With the growth of the global economy the importance of understanding the nature of factors related to multicultural and international diffusion of new technologies has increased. A substantial literature dealing with global diffusion has emerged over the past few years. A comprehensive bibliography of research on this topic is provided in DeKimpe et al. (2000). In a recent paper Kumar and Krishnan (2002) use the Generalized Bass Model in a study of cross-country effects of diffusion and find empirical support for lead-lag, simultaneous, and lag-lead effects of diffusion across countries.

Finally, in the area of significant frontier research in diffusion modeling, I want to discuss some important theoretical developments in the area of generational diffusion models. Although the Norton-Bass model (Norton and Bass 1987, 1992) has been shown to fit generational data quite well over a range of product categories and dependent variable measures, it has some significant limitations with respect to the interpretation of the meaning of the equations when it is applied in situations other than when there is continuous repeat purchasing by adopters of each generation. In a recent work Bass and Bass (2004) demonstrate a method for overcoming these limitations and for providing appropriate interpretations of parameters and variables for a broader class of dependent variable measures. It turns out that there is an embedded model within the Norton-Bass model that provides the basis for a wider class of applications. This embedded model provides the basis for applications when the generations are subscription services (e.g. cellular telephone), systems-in-use (e.g. computers), and for sales of products purchased once each generation, except for leap-frogging (e.g. personal computers). Moreover, through the discovery of a method for expressing the model in terms of a system of two recursive equations it is possible to identify, decompose, and compute important

quantities that were previously not identified. Based on this method it is possible to compute estimates of sales, adopters, replacements, systems-in-use, switchers, leap-froggers, diffusion of base technology, the cannibalization factor, and several other newly identified quantities. This important new theoretical development should significantly expand the application areas for generational diffusion models as well as enhance the value of the models through enhanced understanding of the models and their underlying components.

## 7. Beyond the Diffusion Modeling Frontier

It is gratifying to look at the rich body of knowledge that has been and is being created by Bass Model-spawned research. The natural question is “What’s next?” But, rather than simply predicting the next big thing in diffusion modeling, a more productive question is “What could we (the research community) do to accelerate the pace and improve the quality of research in this increasingly important area?” Although there are many possible activities that would be candidates for such a list, I believe there is one that stands above all the rest.

Imagine a database available to all researchers that contains thoroughly researched and refereed historical data series complete with supporting qualitative information, data collection methodology, data quality assessment, and so on. The database would contain hundreds, if not thousands, of product categories from many different countries with series such as sales, adoptions, penetration, prices, advertising, generational, and other data of the type that diffusion modelers require. But the dream is easy to describe; making it happen is the challenge. I have spent many hours discussing the issues in creating such a database. The challenge would be great, but perhaps not insurmountable if we think big enough. The theories and models of any science can only be as good as the data with which they are validated. Perhaps it is time we take the next step in diffusion modeling and make diffusion data part of our science.

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