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BLAZING SADDLES: THE EARLY AND MAINSTREAM MARKETS IN THE HIGH-TECH PRODUCT LIFE CYCLE

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In this article, we showed the results of our study on the saddle phenomenon by an analytical model of two markets—early and mainstream—and the relationships between them. This model creates a growth pattern wherein a saddle can be discerned. We tested this model empirically on seven product categories, and in only one (cell phones) was a clear saddle not observed whose length was at least one year. Moreover, of the six remaining products, the partial communication break model of the dual market succeeded in explaining clearly the dropoff in sales in four categories: PCs, VCRs, video games, and cordless phones. Of the two remaining categories (CD players and answering machines), a dual market was observed, yet the model did not yield a dropoff in sales, but rather a clear delay in the adoption process.

1. INTRODUCTION

In many cases, regarding technology-based products that emerged in the past decade, when marketing managers discuss these products' entry into the marketplace, they speak of a market comprised of two sub-markets: the *early market* and the *mainstream market* (Moore 1995, 1991). The assumption that underlies Moore's approach is that each of these markets is characterized by customers whose needs and desires differ from each other, and that there is no communication between them, and therefore, the firm's mode of marketing to the early market must necessarily differ from that to the mainstream market. If the firm does not make a significant change in its marketing strategy, the chances are very good that sales of the new product will decline significantly. This fundamental assumption contradicts traditional marketing theory: Diffusion theory views the product adoption process in the market as a process of ongoing and uninterrupted communication between consumers that drives and advances sales of the new product (Rogers 1995; Mahajan, Muller, and Bass 1990), and does

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not recognize a break in the communications process. Moreover, the prevailing wisdom is that the early adopters of a product are opinion leaders who communicate with the entire market and who influence it; Moore even claims that not only there are no opinion leaders, but that any that might exist have no influence over the mainstream market.

Moore's theory, also called the *chasm theory*, was enthusiastically accepted by managers, particularly in the field of technology. However, despite this enthusiastic acceptance—and despite the many possible implications that it has for new product marketing strategies—the literature has paid only scant attention to it. It can be seen that in cases where the chasm phenomenon exists, there is a need to make significant changes in the new product's marketing strategy (Mahajan and Muller 1990), yet there exist almost no empirical studies that either support Moore's claim or refute it, except the few testimonies that Moore himself offers.

If there is a break in communications between the early and mainstream markets, it affects the new product's actual entry pattern. If in a situation of full communication, the sales curve rises steadily over time, then in a situation of a partial break in communication, the graph takes on a saddle shape, i.e., an initial rise, a fall in sales for a certain period, and thereafter, another rise.

The saddle's dimensions (depth and duration) are related to the nature of the inter-consumer communication. From the product's entry pattern, we can empirically estimate the relative incidence of cases wherein the communications break occurs and its intensity. Later in this article, we shall see that this incidence is actually quite discernible. We shall use as examples new products in the home electronics domain in the past two decades.

The results of our study show that in four out of seven product categories (PCs, video games, VCRs, and cordless phones), there was a significant break in communications between the innovators and the mainstream market; and one more product category (CD players) is expected to fall into one of the four above-named categories.

In this article, we will present results from our study on the saddle phenomenon in two forms: First, in building an analytical model of two markets—early and mainstream—and the relationships between them. This model produces growth patterns in which the saddle phenomenon is expected to appear. Second, we will present other empirical evidence that testifies to the existence of the saddle. In the sphere of consumer goods, we tested the model empirically in the seven product categories named above. Besides this, we also present evidence of the saddle's existence in industrial product markets.

Because our sense was that the saddle phenomenon exists and is pronounced in industrial markets despite the scarcity of empirical evidence thereof until now, and because of the presence and importance of the high-tech industry in Israel's economy (Flug and Strawczynski 2003), during the third quarter of 2002, we carried out a survey whose objective it was to examine the saddle phenomenon among Israeli high-tech firms. This study took the form of a series of depth interviews with 30 top Israeli high-tech managers in telecom, communications networks, semi-conductors, phone support, defense, and computer-aided production engineering (CAPE), biotechnology, and others. Indeed, the results of our survey show that in Israeli high-tech, the saddle phenomenon most assuredly occurs. This article discusses the properties that the phenomenon takes on in Israel, and its implications for decision-makers.

2. INTER-CONSUMER COMMUNICATION AS A BASIC COMPONENT OF MARKET GROWTH, AND ITS CONNECTION TO THE SADDLE PHENOMENON

2.1. Inter-consumer communication as a basic component in the growth of markets, and its connection to the saddle phenomenon

The term *innovators* indicates the well known classification by Rogers, beginning with the same 2.5% of the population that is the first to adopt any given product. Various researchers have used the term "innovators" to describe an initial market that actually includes the first 16% of adopters, Rogers's innovators group, and early adopters (Mahajan, Muller, and Srivastava 1990; Midgley 1977; Summers 1971). Until not long ago, the conventional wisdom was that early adopters were for the most part also opinion leaders (Kotler 2002; Perreault and McCarthy 1996). Opinion leaders can be perceived as those who "have an inordinate effect on others through personal influence" (Summers 1971). Actually, the importance of this group can be attributed to the fact that they tend to disseminate information by word of mouth, as the majority of consumers look to early adopters for signals (Perreault and McCarthy 1996). Findings of an empirical market study on the topic—mostly from the 1960s and '70s—tend to support the idea that early adopters also tend to be opinion leaders moreso than others (for example, see Gatington and Robertson1985; Midgley 1977; Engel, Blackwell, and Keterreis 1969; and Bell 1963).

Moore expands on Rogers's normal growth curve and on Rogers's division into adopter categories along the curve to explain how products spread in the market. At the same time, he sees discontinuity in the process after about 16% of the population adopts an innovation. At this point, the social process of the product's entry into the market is cut off because the mainstream adopters refuse to trust information that reaches them via the early adopters, or the early market.

Moore's explanation for this phenomenon focuses on the difference between adopters in the early market and consumers in the mainstream market. The early adopters are more interested in the new technology itself and the use they can make of it as a window of opportunity for their firms and themselves. They are influenced by like-minded people in other industries, and are willing to purchase products that may be costly and incomplete as far as support, reliability, and compatibility with existing infrastructure.

Mainstream market purchasers of technological infrastructure are not particularly interested in the technology itself, and are unwilling "gamble on the outcome". They expect to receive a total and reliable solution, alongside support and compatibility with their infrastructure, all at a reasonable price. Because of the differences between the demands of these two adopter groups, mainstream market consumers tend to be influenced only by those consumers who are similar to them in their thinking.

The break in communications between the early and mainstream markets is likely to lead to a slowing down of growth in the market of the new product. Even though the "visionaries" have adopted the product, the absence of communication between they and the "pragmatists" delays the product's overall entry into the marketplace.

According to Moore (1991), the break in communications between the early and mainstream markets is utter and total. In such a case, sales of the product screech to a halt, the early market having adopted the product to the point of saturation, yet the message not having reached the mainstream market, which is not yet ripe for adoption. Moore calls such a situation the *chasm*. In practice, a situation of a partial break in communication—where the early market has a *limited* influence over the mainstream market, yet not necessarily a *total* lack of influence—is more likely. If this is the case, then we can expect a decline in total sales after which, with its entry into the mainstream market, the product enjoys growth once again.

As the traditional approach to marketing assumes a steady rise of the number of adopters over time, any fluctuation or fall in sales arouses concern among managers and creates a loss of confidence in the new product on the part of executives. Managers and representatives of venture capital funds with whom we spoke testified to the fact that a falloff in the adoption curve in the beginning stages, instead of the rapid rise that is expected, can cause a cessation of investment in the product. Support for this phenomenon can also be found in testimonies from previous studies (Golder and Tellis 1997).

The question of the exact timing of this falloff has been researched by Muller and Yogev (2006): From the moment that a falloff in sales occurs, its intensity and dimensions can be modulated by a significant shift in marketing strategy, so that it focuses on tweaking the features of the product to the needs of the mainstream market, or by shifting the allocation of resources channeled toward innovator customers relative to those channeled toward mainstream customers (Mahajan and Muller 1998).

In our previous article (Goldenberg, Libai, and Muller 2002), we described the falloff in sales during the transition between the early and mainstream markets as a "saddle", and researched the properties of such falloffs using a stochastic cellular automata model. In addition, we tested for the existence of a saddle in 32 new markets in the US, and we showed empirically that saddles appeared in 50% of the product categories tested.

In this article, we will go further in depth, and expand the discussion on several levels. First, we shall present an analytical model that is not based on simulations, that attempts to describe the formation of saddles based on accepted assumptions regarding new product entry into consumer markets, assuming the existence of a dual market. In addition, we present more empirical evidence to the effect that the phenomenon is indeed common across various industries. Further, we present new data from a data set that has still not been made use of for this purpose, and which shows the existence of the phenomenon. In particular, we show formal evidence of the saddle's existence even in industrial markets, based on data from Israel's high-tech sector.

3. A MODEL FOR MARKET GROWTH FOR A NEW PRODUCT GIVEN A PARTIAL COMMUNICATIONS BREAK

Consistent with the theory presented above, let's assume two main groups of adopters: an early market, and a mainstream market. Let i be the early adopters, or *innovators*, and m be the mainstream market, or *majority*. Consistent with the Bass model (1969), Let N_i be the

early market potential, and let N_m be the mainstream market potential. Coefficients p and q are an external coefficient (i.e. marketing efforts) and an internal coefficient (mainly word of mouth), where p_i and q_i serve relate to the early market, and p_m and q_m relate as to the mainstream market. q_{im} represents the communication between the early market consumers and those of the mainstream market. I denotes the number of adopters from the early market population, and M denotes the cumulative number of adopters from the mainstream market population. Adoption among the early market progresses along a Bass progression in the following way:

(1) $$dI / dt = (p_i + q_i I/N_i) (N_i - I)$$

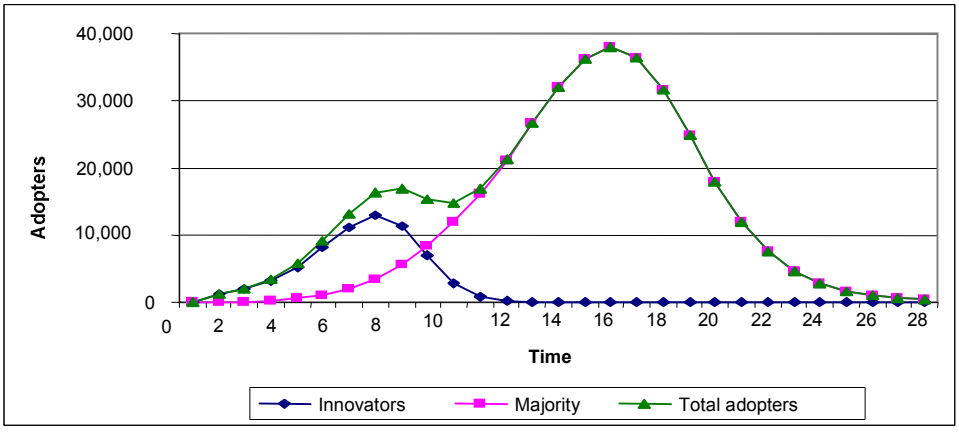
In the mainstream segment, word-of-mouth activity breaks down into two components: word of mouth among the mainstream market population (q_m), and cross-market communication between the early and mainstream markets (q_{im}). The equation is as follows:

(2) $$dM / dt = \{p_m + q_m M/(N_i + N_m) + q_{im} I / (N_i + N_m)\} (N_m - M)$$

Note that Bass (1969) is a private case of this equation, a case in which there is one market only, or $M(t) = 0$. Similarly, Tanny and Derzko's (1988) two-stage model is a special case of comparison of Equations (1) and (2), where $p_m = 0$ and $q_{im} = q_m$. The relationship to Mahajan and Muller's (1998) two-stage model is slightly more complex, due to the fact of the last model's having in its equation a parameter of a non-uniform effect, as well as another expression representing advertising that is a more central element in the mainstream market. At the same time, the dynamic of the two models is identical in terms of conditions of $\delta = 0$, and that in Equations 1 and 2, $q_i = p_m = q_{im} = 0$ exists. Figure 1 shows the solution to Equations 1 and 2 for the following parameter set:

$p_i = 0.02$, $q_i = 0.75$, $p_m = 0$, $q_m = 0.5$, $q_{im} = 0.07$, $N_i = 65{,}532$, $N_m = 344, 291$

Figure 1
Growth in a dual market according to Equations 1 and 2



These parameters are average values of the parameters of five specific products in the *Economist* model, discussed in Section 4. The conspicuous property in the growth pattern in Figure 1 is the falloff in sales in the early part of the growth stage, in which, according to traditional growth theories, monotonous growth is expected.

Before presenting the empirical analysis herein of the partial communications break model, we can ask if the set of Equations 1 and 2 is indeed essential, or if it is possible to include the phenomenon in an existing model. Below, we summarize our findings regarding a few models that are candidates for such a task. We emphasize that the following words intended as covert criticism of these models, and that these models were built for this specific use:

- The basic Bass (1969) model: This function has been well researched, and its shape is single-peaked. A falloff in sales necessarily means two peaks. The equation set that we presented is an expanded version of this model in a dual-market case.
- The Non-Uniform Influence (NUI) model (Easingwood, Mahajan, and Muller 1983): This is a flexible model that contains an asymmetric growth pattern. Its main feature is a non-linear expression that describes a pattern of a falloff in word-of-mouth behavior. Because this model does not have a close-form solution, we ran a 1,000-run simulation on a reasonable parameter set using the Crystal Ball simulation software. Although asymmetrical growth patterns were observed, all of them were single-peaked , and therefore we ruled out the possibility that in a specific parameter set this model would show a falloff in sales.
- Mahajan and Muller's (1998) two-stage NUI model: This model has two stages where in the mainstream market is non-uniformly based on word-of-mouth activity of the early market. Because the model does not have a close-form solution, we ran a 1,000-run simulation on a reasonable parameter set using the Crystal Ball simulation software. No falloff in sales was detected, the reason for which is that there was no assumption that word-of-mouth activity took place in the early market, and that a falloff in sales necessarily means a decrease in the quantity of innovators who purchase the product.
- Tanny and Derzko's (1988) two-stage model: A two-stage model in which for the most part there is both internal communication and cross-market communication with the innovators. Because the model does not have a close-form solution, we ran a 1,000-run simulation on a reasonable parameter set using the Crystal Ball simulation software. No falloff in sales was found for the same reason that these were not found in the Mahajan-Muller model: If the innovators do not engage in word-of-mouth communication, then no falloff in sales occurs.
- Goldenberg, Libai, and Muller's (2002) cellular automata model: This is not an analytical model, but rather a simulation that describes the development of the market as a collection of decision-making and adoption processes on the part of individual consumers. Besides this, the model is stochastic in nature, and its underlying assumption is that consumers' decisions regarding whether to adopt a new product or not are random in nature. Based on an analytic model in which the problem described is similar to that proposed here, we can explain the falloff in sales as stemming from the basic structure of the market, and not as a result of random properties of decision-making properties on the part of the individual.

4. AN EMPIRICAL ANALYSIS OF THE SADDLE PHENOMENON IN B2C MARKETS: HOME ELECTRONICS

Our empirical analysis is based on a data set from the Electronic Industries Alliance (EIA) in the US on sales of new products purchased in 2003. This set contains data on sales and prices of electronic consumer goods in the US through 2002 inclusive. All of the sales are expressed in thousands of units, except for those of video games, which are expressed in their dollar value divided by their unit price, according to a survey by Frost and Sullivan.

A known problem in evaluating models of this type is the paucity of information points from which certain changes in the model derive: First, we determined the external marketing coefficient of the mainstream market (p_m) to be zero. A second known problem is that evaluating the overall market potential is not stable for those products for which a peak in sales has not been reached. Therefore, regarding the three products for which sales still had not peaked (cell phones, video games, and answering machines), we set the size of the mainstream market to be external to the regression, or about 30% more than sales for 2002. For the rest of the products, we evaluated the parameters (as above, except for p_m, whose value was set at zero). The regressions that we performed are non-linear regressions in which the coefficients of Equations 1 and 2 were estimated for each of the products individually (for more on use of non-linear least squares in new product diffusion modeling, see Srinivasan and Mason 1986). Both equations for each product were estimated simultaneously, where the target is the minimum sum of squares of the differences between the information on actual sales and the **sum** of both equations. All parameters were found significant at $p < 0.05$, except for those explicitly marked otherwise.

As aforementioned, the choice of the product categories to be tested was based on the March 2001 *Economist*, and they are: the PC, the cordless phone, the VCR, the video game, the CD player, the answering machine, and the cellular phone. Although we can take issue with *The Economist* over the fact that it did not include in its lists some successful product categories, such as video cameras or printers, the importance of this list for the purpose of the present analysis stems from the fact that the source that evaluated it is independent in relation to our analysis. Therefore, we chose to relate to these seven product categories as one model. A summary of our findings is presented in Figure 2, in which three products in whose sales pattern a saddle is observed are demonstrated, and in Table 1.

First, notice that of the seven product categories, in only one (cellular phones) is a clear saddle of a year's duration not observed. Moreover, but of the other six products, the partial communication break model of the dual market succeeded in clearly explaining the falloff in sales in four product categories: PCs, VCRs, video games, and cordless phones. Of the remaining two products—CD players and answering machines—the configuration of the dual market was confirmed, yet the model did not yield a falloff in sales, but rather only a discernible delay in adoption, as we can see in Figure 3.

Table 1
A summary of the *Economist* model

	PCs	Cellular phones	VCRs	Video games	CD players	Answering machines	Cordless phones	Average
# of observations	23	19	29	17	30	21	23	23.1
Period of analysis	1980–2002	1984 – 2002	1974 – 2002	1990 – 2002	1983 – 2002	1982 – 2002	1980 – 2002	
p_i	0.05	0.00*	0.00*	0.02~	0.00*	0.02	0.02*	0.02
q_i	0.31	0.21	0.69	0.55	0.54	0.40	1.67	0.62
q_m	0.41	0.66	0.27	0.66	0.88	0.24	0.27	0.48
q_{im}	0.02	0.19	0.08	0.02	0.02	0.11	0.23	0.10
N_i	29,546	133,472	54,729	88,858	143,872	79,106	10,652	77,177
N_m	171,847	400,000	297,425	350,000	340,647	350,000	561,535	353,065
Adjusted R square	98.3%	98.3%	94.1%	98.4%	99.7%	98.9%	96.6%	97.8%
Decline in data	Yes	No	Yes	Yes	Yes	Yes	Yes	6 of 7
Decline in model	Yes	No	Yes	Yes	No	No	Yes	4 of 7
Dual market	Yes	No	Yes	Yes	Yes*	Yes*	Yes	6 of 7

* - not significant at p-value = 0.05

~ - significant at p-value = 0.01

Yes* - Although the estimate includes a dual market, the difference is such that there is a delay in the adoption, yet not a decline.

Note that despite the fact that the falloff in sales is not steep, occasionally (such as in the case of the CD players), it is manifested only by a delay in the dispersion process, and not in an actual decrease, which would have a decisive effect on the new product's continued success. Because of the traditional marketing approach, which describes adoption as a continuous communication process, managers expect a steady, steep increase in the early stages of a product's entry into the marketplace. This expectation influences the firm's evaluation of the product, and in turn its recruitment plan and where it will invest its resources. Any falloff or moderation in the adoption curve in the early stages creates a gap regarding the forecast, and may result in the firm—in many cases a young one—experiencing financial difficulties. Moreover, managers may interpret the falloff as an indication that something in the new product is amiss, and may halt the entry process.

Figure 2a
Sales of VCRs in the US (in 1,000s of units)

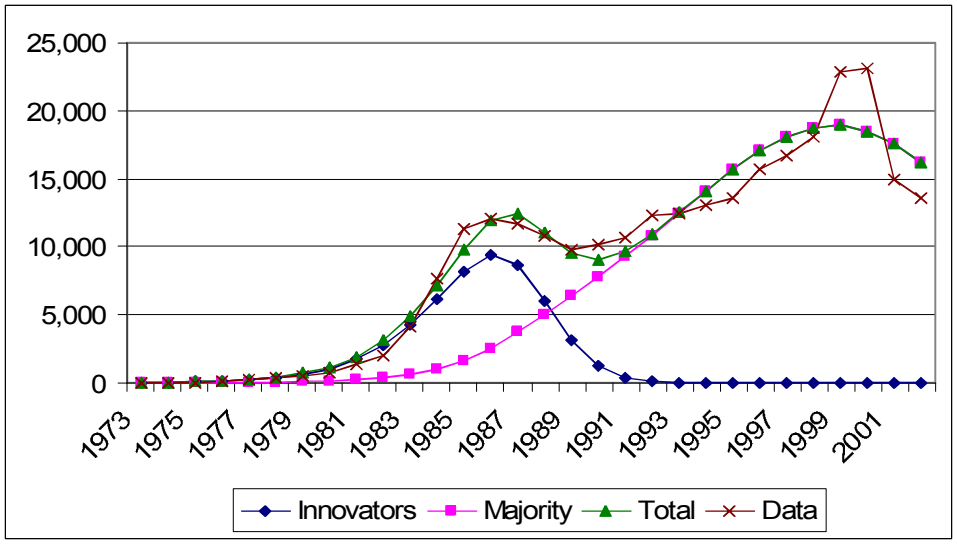


Figure 2b
Sales of video games in the US (hardware only, in 1,000s of units)

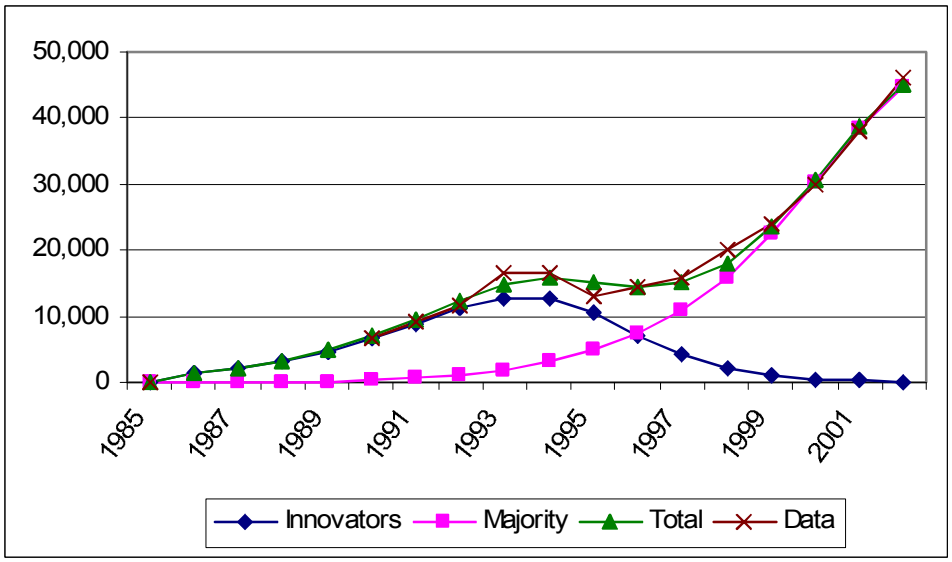


Figure 2c
Sales of cordless phones in the US (in 1,000s of units)

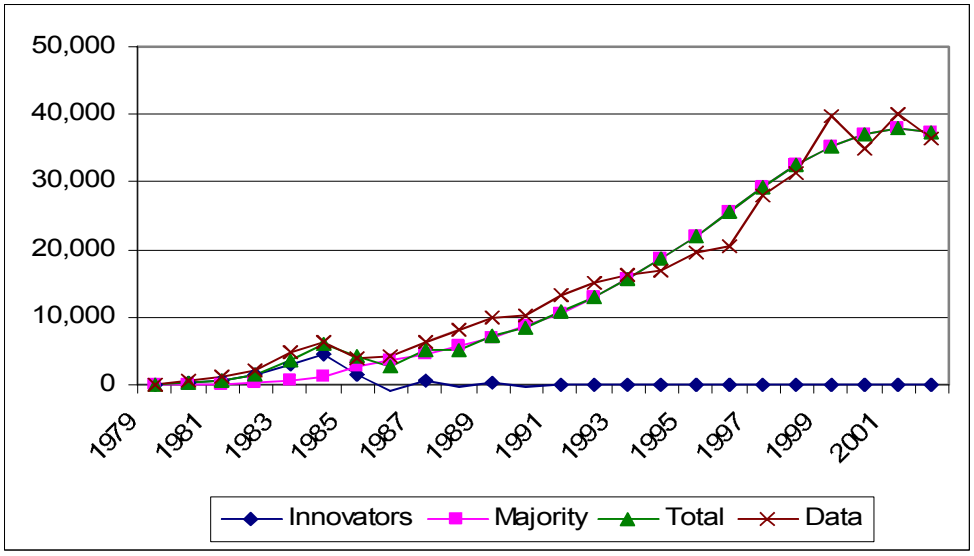
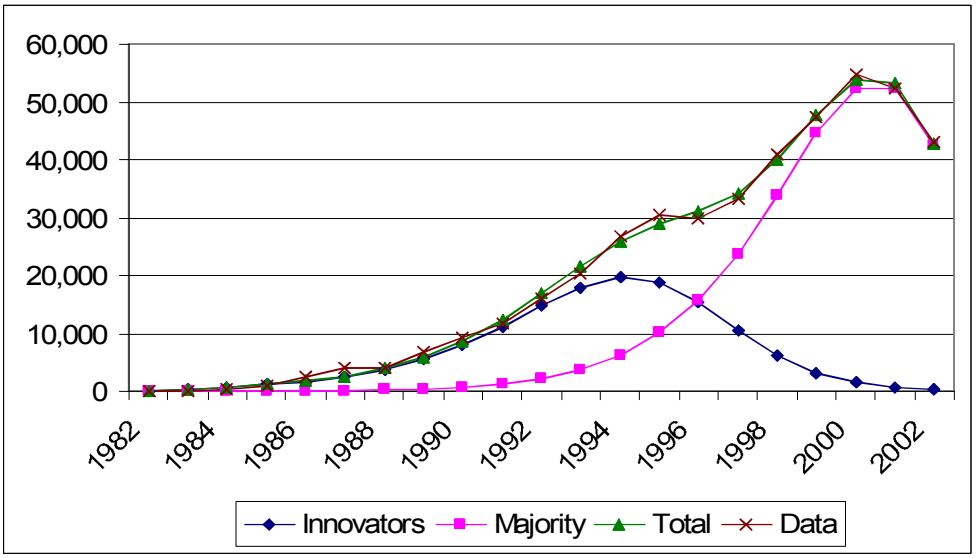


Figure 3
Sales of VCRs in the US (in 1,000s of units)



Regarding the cell phones, which are the only category in which no delay in sales was observed, our results point to segmentation into an early market and a mainstream market not having occurred. However, this does not mean that other segmentation cannot be beneficial. For example, Jain, Muller, and Vilcassim (1999) reported segmentation of this market into two segments: one of business users, and one of personal users. It appears that these segments belong neither exclusively to the early market nor to the main market, but rather are dispersed between the two.

Generally, the model functioned well, with adjusted R Square at a rate of 94% to 99%, and with an average of 97.8%. We also noted that the average inter markets communication parameter (q_{im}) was quite a bit lower than the word-of-mouth coefficients of both the innovators and of the mainstream market (q_i *and* q_m). Furthermore, we can see in the table that not only is the average far lower (proportionately speaking), but also that in all cases, without exception, the cross-market communications coefficient is lower than the word-of-mouth coefficient both within the innovators and within the mainstream market. In our opinion, this fact, together with the model's ability to contain the sales falloff, confirms the basic assumption of the partial communications network with the dual market model.

5. AN ANALYSIS OF THE SADDLE PHENOMENON IN ISRAEL'S HIGH-TECH SECTOR

5.1 The objective and method of the survey

Below is a survey aimed at studying the saddle phenomenon among Israel's high-tech firms. New, technology-based products in many industries are marketed B2B, i.e., sold to businesses, as opposed to individual consumers. Such industries fill an important role in the economies of many countries, and Israel is no exception.

Obtaining quantitative sales data for B2B products, like that shown here for consumer products, is difficult and complicated due to the absence of professional associations that publicize data in an organized way. Even Moore's theory, though based on his experience in high-tech, is not backed up by organized empirical data, but rather provides only a few anecdotal examples. For this reason, our study was conducted as a qualitative survey of executives in Israeli high-tech. The assumption that underlies the survey is that the experience and intuition of this sector's executive personnel serve as an effective tool for picking up signals—even if they are initial signals—for the existence of a mechanism and tendencies.

The study consisted a series of depth interviews with 30 senior managers in Israeli high-tech, including telecom, networks, CAPE, semi-conductors, call centers, defense, and biotechnology. The survey was conducted during the third quarter of 2002, and the interviews reflect the years 1986-2002. Not a single interviewee spoke of events prior to 1986.

Some of the interviews took place in the interviewees' offices or homes, as they chose. One interview was conducted by telephone. The questions were partly open: The questionnaire served as a guide, yet the interviewees responded freely. A typical interview lasted 60-75 minutes. The sample was a convenience sample, chosen mainly on the basis of

previous acquaintance with the interviewees. The Tel Aviv University School of High-Tech Management also served as a source. Not a single candidate refused to take part.

Two pre-tests (internal) were performed on two firms: Sanctum and Scitex, as two interviews that appear similar were conducted with two different managers. Regarding all of the firms, the basic data (events, post-IPO revenues, and so forth) were verified with data that the firms published in financial reports, the press, or in industry surveys.

We emphasize that the survey was qualitative in character, and its aim was to gain an initial understanding of whether in the present Israeli reality, the saddle phenomenon is as widely occurring as it is in the rest of the world. The sample was not random and no efforts were made to ascertain the level of credibility of the results beyond the sample. Therefore, we do not recommend including them in the results to be presented.

5.2 Profile of the interviewees

Thirty managers took part in the survey—three women and 27 men. All hold executive positions in Israeli high-tech firms that have introduced at least one new product category into the market. Table 2 lists their respective positions. The interviewees were asked if they have observed a saddle pattern in entry curves at the early stages of their respective products' life cycles. The term "saddle" was defined for the interviewees as a slowdown or falloff in the speed of adoption of the product. It was notable that nearly all of the interviewees were familiar with Moore's book, which discusses a similar phenomenon, and said that they had already given thought to saddle-like entry patterns.

Table 2
Breakdown of positions of the interviewees during the relevant period

Positions	Number of interviewees who held them
CEOs, Presidents, Chairs, members of Board of Directors	12
CFOs	3
Founders	5
Vice Presidents of Marketing / Business Development	8
Consultants	1
Service Engineers	1

5.3 The findings: The saddle exists

Twenty-two of the interviewees reported that they had experienced a saddle for at least one new product. Managers of seven of the firms (including Amdocs, Nice, Checkpoint, and Comverse) reported that they had never experienced a saddle. One manager could not recall. In some cases, the company had experienced one saddle. For example, Ubique, an AOL spinoff, almost certainly Israel's first Internet startup, experienced a 50% drop in the number of adopters (in 1988), and only after six quarters did their market revive.

Firms that manufacture a range of products, Scitex, for example, have experienced saddles in many of their innovative products. Actually, Scitex's managers began to get used to the onset of the saddle, and viewed it as a natural stage in the product's launch. Sales of one of Scitex's scanning products, Scitex CCD, fell for two years into a deep saddle that could even be termed a chasm, yet managers continued to believe in the product and to try to disseminate it in the marketplace.

Table 3
Breakdown of business areas in which the firms are engaged

Area	No. of firms
Printer circuit testing	1
Bar codes	1
Biotechnology	1
Telephone support centers	2
CAPE	2
Defense	1
Digital printing	1
Home robots	1
Internet	2
Medical devices	1
Computer communications networks	3
Computer communications network control	1
Pharmaceuticals	1
Software and network security	4
Semi-conductors	1
Software	4
Telecom	2
Software testing	1

5.4 The dimensions of the Israeli saddle

How deep is the typical Israeli high-tech saddle? Occasionally, a saddle is not a definitive dip, but rather a more moderate slowdown—or a halt in growth—in sales. If a firm has several product lines, it is likely that a saddle will have no effect on the firm's total revenues, and therefore it will not show up in the financial statements. The median value of the depth of the saddle is 20%. It emerges from executive reports that the shortest saddles last 3-4 quarters. Average saddle duration is 6-8 quarters, much longer than usual for consumer goods.

An interesting case is the Compugen saddle, which to all appearances was the most difficult. Compugen is engaged in algorithms for genetic and protein research. It was founded in 1993, registered its biggest sale of $3 million (to Merck) in 1994, and then fell into a deep chasm of nearly zero sales until 1999. Thereafter, growth revived; in 2001, Compugen's revenues totaled $5.1 million.

5.5 Product categories that do not have a saddle

All of the managers, aside from those who had not experienced a saddle, were asked what characterizes a product category whose spread into the marketplace has not included a saddle. Following is a summary of their replies:

- **Markets with a small number of customers, such as the defense and semi-conductor industries** - Here the market potential is only a few dozen customers; years may pass between new customer acquisition, and most of the revenues are from repeat sales, service districts, and so forth. Therefore, the significance of adoption curves is lower, as exemplified by those shown herein.
- **Demand in large markets** - Certain markets, such as cellular telephony, grew considerably in a short time. The cellular companies were compelled to launch services on narrow timetables, which necessitated the rapid setup of software, hardware, and infrastructure service systems, from the ground up. The suppliers to this market (Amdocs and Comverse, for example) enjoyed strong demand and did not experience saddles. Scitex's managers understood intuitively that creating strong demand at an early stage of entry could prevent or reduce a saddle's dimensions. They therefore grew accustomed to creating demand in the market by creating a limited quantity of items in early versions, and let their distributors and customers compete for who would be the first to acquire the new product.
- **Markets that develop slowly, such as software application security** - In these markets, the development of technology and the organizational capabilities of the firms' sales and service networks is slow compared to the speed of word-of-mouth spread between customers, and therefore the speed of growth in the market— not the nature of the demand—dictates firms' abilities to provide a solution to customers, i.e., supply.
- **Vulnerability to a saddle is lower in ongoing inventions, i.e., innovations that are continuities of existing products** - One interviewee remarked that although it's reasonable to assume that technologies that do not create a new category have lower chances of falling into a saddle, venture capital funds and investors are not enthused about investing in such technologies.

How can these replies be interpreted in terms of inter-category communication on the part of adopters? It appears that a high level of intra-market communication (slow development compared to the speed of development based on word-of-mouth information, a small market, high demand) should aid in preventing a saddle.

5.6 The existence of an early market and a main market

The organizational high-tech market is considered quite innovative. It was interesting to investigate whether a dual market could be identified therein, of early and mainstream adopters, or whether all organizational customers are innovative to the same extent. This question was presented in two parts. First, the interviewees were asked if they have customers who adopt early and customers in the mainstream market. Afterward, they were asked if the level of innovation changes steadily, or if the structure of the market is binary, i.e., early innovators vs. conservative consumers.

All of the interviewees agreed that customers do differ from one another in their levels of innovation. Twenty-five interviewees declared that the structure of the market is binary in its levels of innovation in the early stages. Early adopters are estimated to constitute 5%-15% of the market. In the semi-conductor control industry (the target market of Applied Materials), the market is unified and tight, and therefore the early market constitutes 60%-70% of the market, the rest being laggards who enter late in the game.

Who are the early adopters? The answer depends on the industry in question. The interviewees claimed that in many cases, these adopters are gadget-lovers who work in the customer-organizations; in fact, innovators may be part of a conservative organization. The early adopters of Radcom, which produces network testing equipment, were engineers at AT&T, a company that is known not to be innovative in terms of infrastructure, yet its technical employees preceded internal sales and convinced the rest of their respective divisions to purchase Radcom's product.

In a few cases, the customer is an organization characterized by innovation, and so the organization as a whole tends toward early adoption of new products. In telecommunications, it is known that the Spanish Telefonica and the Finnish Sonera are early adopters. By the same token, the IDF is an early adopter of Israeli defense technologies. Organizations that derive high value from technology should be *ad hoc* early adopters of certain technologies. For example, Magic's early customers were small software houses that significantly improved their development processes using Magic's new development platform. Reducing development time has a strong effect on software houses' ability to develop several products at the same time. In certain markets, the need for a technology is a result of a new regulation imposed on service providers. Thus, companies such as Mint have made their mark, as well as digital recording systems such as those produced by Comverse. If a company is aware of their customers' regulatory needs, it has a good source of early adopters.

Are start-ups early adopters? It is perhaps surprising to discover that software firms such as New Dimension (BMC) report that in many cases, start-ups are quite conservative in choosing their equipment and software, the assumption being that start-ups concentrate so hard on their core activity that they choose not to invest effort in trying new products.

An important point that emerged during the interviews was that defining an early and mainstream market is done from the point of view of the company selling the new product. Innovative customers do not like to admit the fact that they are guinea pigs of an industry. Although they want to be perceived as technology leaders, at the same time, they want to project an image of an organization that purchases only established and reliable products.

5.7 The structure of intra-market communication

All of the interviewees agreed that in technology-based industries, great importance lies in word-of-mouth recommendation and imitation between customers. The target customers in a market create among themselves an extensive communication network, both formal and informal, and the level of communication activity in the market is high.

In software, similar customers from the same geographic area tend to use the same infrastructure. Therefore, they use each other as sources of recommendations. In the

defense sector, word-of-mouth information is likely to be obstructed by compartmentalization and security classifications. Therefore, such communication is restricted to sectors that have strategic treaties between them, such as NATO members, Israel and Singapore, and so forth). When there are two markets, communication between the early and mainstream markets is vital to the progress of the entry process. All of the interviewees agreed that the mainstream market communicates with the early market. At the same time, the *level* of interaction changes between markets.

The picture that emerges from the interviews is that the mainstream market feels ambivalent toward the early adopters. On the one hand, the mainstream consumers appreciate the early adopters, because the latter understand the technology. On the other hand, the mainstream considers the early market "technology addicts", meaning that they adopt every new technology that comes along just because it's new.

In most of the industries that we studied, the managers said that the mainstream customer always prefers the recommendation of a fellow mainstreamer to that of an early adopter. At the same time, early adopters have a decisive influence because in many cases, at stake are established and respected organizations that have acquired reputations as being both innovative and reliable.

In the medical devices and pharmaceutical industries, product entry is planned especially to use the early adopters and their word-of-mouth communication. Early adopters in these industries are respected physicians at clinical research institutes who publish their findings at scientific conferences—which in turn are funded by the medical associations—and the rest of the markets follow in their wake.

5.8 Negative word-of-mouth communication

In organizational purchasing, the price of an unsuccessful purchase can jeopardize the career of the relevant decision-maker. Therefore, negative word of mouth can be a serious obstacle to the entry of a new technology. Because negative word of mouth means that the customer knows of the failure to choose the right product and to integrate it into the organization, organizations tend to spread bad news; and when they do, the disrecommendation passes easily through the market.

5.9 Sale to the early market

Much has been written about strategies that should be used to appeal to the mainstream market. At the same time, because a product's entry is initially into the early market, comprised of early adopters, the needs and desires of this market must also be answered to. The main motivator for purchasing among early adopters is technology. For example, in the semi-conductor control industry, the R&D engineers lead the sales process for the early adopters. Although the sales process is managed by sales personnel, in actuality, it is the engineers who sell to other engineers. In its early days, Radcom worded and designed its newspaper ads specifically to attract early adopters. Radcom invested special efforts in the external design of the product, hiring an industrial designer to give the product an innovative look that would appeal to early adopters, i.e., gadget lovers and "technology geeks".

What happens if a company should try to disappear from the early market and appeal directly to the mainstream market? Friendly Robotics is an interesting test case of such an attempt. Friendly Robotics is engaged in home robotics, its best-known product being its self-piloting lawnmower. FR began distributing this product to department stores. It was too early for the mainstream market, and they did not adopt. Early adopters don't purchase electronics at department stores, and even if they do enter such stores, they encounter sales staff who are not technologically savvy. Lawnmower sales in the US are seasonal, so that by the time FR realized what was happening, it was in a deep chasm, without the financial means to recover. FR was recently acquired by Hoover, which froze the product's entry until the home robotics industry recovered. Regarding internal (word-of-mouth) vs. external (advertising and a sales team) modes of publicity, it was agreed that direct sales by engineers and sales associates is the preferred strategy for the early market. Advertising, product fairs, and so forth are important at later stages. As early adopters disseminate word of mouth, they are willing to try new technologies without prior recommendations from other consumers.

5.10 Is a dual market structure the reason for the saddle?

The theoretical models shown above are intended for the purposes of analyzing the relationship between the dual market structure and the saddle. Most of the firms we studied experienced saddles; nearly all of them claimed that they operate in a dual market. We asked the interviewees if in their opinions, the saddle was indeed caused by the gap between the early market and the mainstream market. The results were inconclusive: 11 managers supported the dual market hypothesis, and others weren't certain or offered other explanations:

1. **Artificial early sales** - Regarding sales to high-tech organizations, early sales are occasionally virtual, not actual. For example, the first customers of digital chips were research labs and groups at organizations that acquired them because they needed to try out the new technology. An established firm such as Comverse will find early adopters for nearly any type of new product from within its existing pool of customers. These customers will buy the new product as part of a total package with the firm, or simply because it's awkward for them to refuse a key supplier. A firm can reach a significant quantity of revenues only from early sales to an existing customer pool or from trial samples and beta systems. In such cases, the saddle is formed by the gap between these early "trial sales" and actual sales based on customers' carefully judged business considerations.
2. **An internal dynamic within the firm** - A saddle can form due to a firm's difficulties in adjusting itself to large-scale activity. Sales of Comverse's digital recording system fell during their first six quarters in the mid-1980s, until the firm completed its OEM agreements[1] with the manufacturers of the switches needed for large-scale activity.

[1] OEM = Original Equipment Manufacturing, an agreement between two firms in which one of the firms takes products or technologies from the other, and uses them as-is for the purposes of developing its own products.

After the market's initial "honeymoon" with a product, firms start to receive declines from the market due to a technical problem with the product or unwillingness to purchase it. This phenomenon has implications for employee morale and sales personnel's security, and can in turn affect the market's efficiency, creating a saddle in its wake.

3. **A blocking notice of industry leaders** - Industry leaders who suddenly learn of a new technology developed by a smaller "upstart" firm that could jeopardize their sales of existing products, can cause a saddle. In order to block the established firms' sales, the smaller firms come out with an announcement that they too intend to introduce a new product or technology. The customers, who know that the entry of leading firms causes upheavals such as mergers, acquisitions, and new standards, delay adoption of the relevant products.
   At the beginning of the 1990s, a technology was developed for the DOS (disk operating system) that supported several users simultaneously. Several small firms developed this technology at the same time, yet its entry into the marketplace was delayed for nearly three years because of Intel's and Microsoft's joint efforts, as they also announced that they were on the brink of introducing a similar product.
4. **New standards** - An innovative technology or new standard that has a good chance of becoming dominant can create a saddle because firms invest great effort in adjusting their innovative products to a new standard that they market has not yet in fact adopted. At the end of the 1990s, the ATM[2] was the "next thing" in computer systems. Efforts by companies that developed new products in the industry to adjust their products to the new technology caused a slowdown in sales and in a few cases, saddles.
5. **Negative word of mouth** - Product categories can dip to a saddle because of negative information spread in the early market by word of mouth. In the printed circuit testing market, a firm named General Automation introduced a problem-infested product that generated negative word of mouth for the technology, in turn causing a dramatic slowdown of the market that lasted several years.

5.11 Israeli firms' ways of dealing with a saddle

In our survey, we noticed several typical patterns of ways that firms and industries have found to cope with saddles; they can be divided into four prototypes:

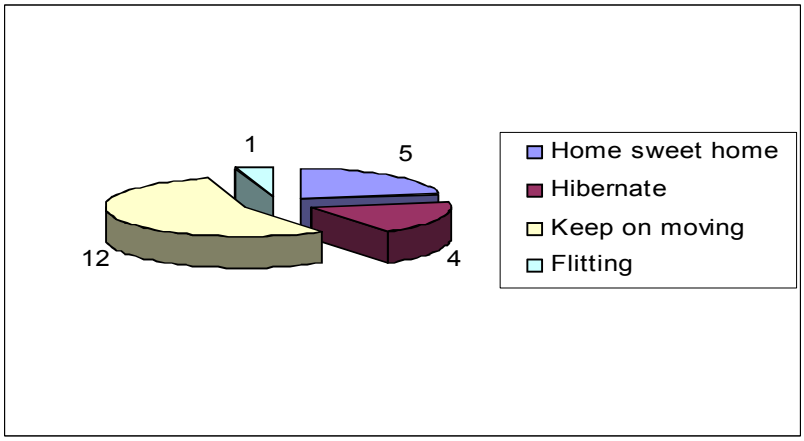
1. **Look for a home sweet home** - When companies / industries arrive at a saddle, they start to look for sponsorship by a larger company. At this stage, industries such as content application industries tend to merge. Similarly, the "search for a home sweet home" strategy is the preferred strategy among Israeli start-ups. In the present sample, there was a sub-representation of start-ups that were acquired by larger firms.
2. **Hibernate** - Here the firm actually halts activity and goes into hibernation until the market revives. If the firm has several product lines, it keeps its hibernating product at a

[2] ATM, or Asynchronous Transfer Mode, a switching technology for computer networks that connects between two networks via a structure of cells, similar to a cellular telephone network.

low profile. If not, the entire category stops and waits. This was the case of the home robotics industry, mobile commerce, or even the third generation of telecom applications, which only in recent quarters have begun to show signs of revival.

3. **Keep on moving** - A firm that keeps on moving believes in their technology and never gives up. Based on our impressions, Scitex demonstrates well the "keep on moving" strategy. Scitex experienced a saddle with several of its innovative products, yet never threw in the towel and "killed" the products in question.
4. **Flitting** - Flitting firms like the thrill of early sales. As soon as they sense an upcoming saddle, they change their target market. Many start-ups managed by venture capital funds are "flitters". One firm surveyed had developed a generic technology for colored barcodes. Since its inception in 1999, the firm appealed to three market segments that differed significantly, and afterwards neglected them. Each time the firm did well in a segment, it left it cold at the first signs of an imminent saddle.

Figure 4
Breakdown of prototype patterns among the firms that reported saddles (number of firms)



This typology is based on impressions only, yet because its rationale is consistent with the quantitative findings shown in Figure 4, it is worth noting that the sample is tilted in favor of orientation to "keep on moving", and less so to those "seeking a home sweet home".

5.12 Activities of "keep on moving" firms

Following are a few actions taken by managers to get through a saddle. Generally, the "keep on moving" strategy can be viewed as mixing and matching, or creating a mix of actions whose objective is to adjust the technology to the changing needs of the market.

- **Change the product** - To penetrate the mainstream market, the firm needs to strip down the product, stabilize it, and adjust it to the mainstream market. To attract the early adopters, the firm needs to add elements or features to the product; yet for the

mainstream market, it's preferable to reduce the number of elements and to focus on performance and stability.

- **Adjustments** - To succeed in the mainstream market, it's important to build a product such that it will be easy to assimilate and integrate into the customer's existing work environment. For example, Radcom developed a tool that enables its customers to tailor its product automatically to the new network protocol. Scitex cooperated with equipment manufacturers to improve the availability of their CCD scanning boards. Optrotech developed products that translate output of old machines to required input for new equipment, despite the knowledge that these products were by definition obsolescent.
- **Transition to mainstream marketing channels** - It is likely that mainstream market sales demand a change in distribution channels. For example, in the call center industry, working with the mainstream market demands a transition from direct sales to working with integrators, or contractors that develop systems for end clients.
- **To keep on moving, you need financial means** - It is incumbent upon the firm to try to find alternative sources of income until the market revives. For example, Compugen went into Internet work and provided biotechnology research services until the market was ready for its main product, the bioaccelerator.

6. CONCLUSIONS AND IMPLICATIONS

In this article, we showed the results of our study on the saddle phenomenon by an analytical model of two markets—early and mainstream—and the relationships between them. This model creates a growth pattern wherein a saddle can be discerned. We tested this model empirically on seven product categories based on an example that appeared in *The Economist*: PCs, cellular phones, VCRs, video games, CD players, answering machines, and cordless phones. Of these seven categories, in only one (cell phones) was a clear saddle not observed whose length was at least one year. Moreover, of the six remaining products, the partial communication break model of the dual market succeeded in explaining clearly the dropoff in sales in four categories: PCs, VCRs, video games, and cordless phones. Of the two remaining categories (CD players and answering machines), a dual market was observed, yet the model did not yield a dropoff in sales, but rather a clear delay in the adoption process.

Because the feeling was that the saddle phenomenon is particularly strong in Israeli high-tech, we carried out a survey whose objective was to examine it among Israeli high-tech firms in B2B industries. Our study was based on interviews with 30 key managers in the Israeli high-tech sector, in the realms of telecom, CAPE networks, semi-conductors, call service centers, defense, biotechnology, and others.

We learned from the survey that a slowdown or falloff in sales was found in 22 of 30 cases. A few firms have experienced a single instance of a saddle, while firms that make several products have experienced more than one saddle. The depth of a typical saddle was 20% (median), and typical duration was six to eight quarters, shorter than the typical saddle

for consumer goods. Product categories with no saddle were found in billing systems, digital intake systems, and Internet security. According to managers' estimations, such categories are characterized by one or more of the following: higher demand levels than the market can supply, slow growth, a small number of players in the market, and a low level of innovation.

Twenty-five interviewees claimed that they operate in a dual market. All agreed that various customers differ in their levels of innovation. Innovative customers can be innovators within organizations, organizations with an innovation culture, or organizations that achieve high value from a specific technology. A saddle can form because of the dual market structure, yet it can form for other reasons, such as early artificial sales, competition between industry giants, transfer of negative word of mouth in the early stages, or an internal dynamic in the firm. Ultimately, firms have a variety of ways of coping with saddles, among them getting acquired by a bigger firm, freezing activity, going over to other target markets, or adjusting their marketing mix and corporate culture to mainstream market activity.

There is practical importance to the awareness on the part of managers who are trying to introduce a product into the marketplace, of the possibility of a saddle's occurrence and understanding the reasons for its forming. A manager who anticipates, based on the traditional marketing approach, a steady and steep rise in the early stages of a product's entry, will normally allocate the firm's means in a non-optimal way, overestimating the scale of production, recruitment, and expected income. The gap between the forecasted activity and what actually occurs may cause firms—that in many cases are young—financial entanglements. On the other hand, managers unfamiliar with the saddle phenomenon—particularly venture capitalists—are liable to "kill" a new product before its time and to withdraw large investments in R&D and market infrastructure.

It is important to emphasize that it is likely that in a total computation done over time, the saddle's effect is not critical in terms of long-term profitability or overall market segmentation, yet managerial decisions are made based on local trends; and regarding managers like those at Compugen, who withstood a saddle of zero sales for five years, the decision whether to continue efforts or to stop activity must be made based on the information and the means at the firm's disposal at the moment, and not a *post factum* analysis of the data.

What measures should managers take when faced with a saddle? The answer depends on the firm's situation, and upon its financial means and capacity. If there is interest in acquiring the firm, it can "look for a home sweet home", i.e., look for a larger and more established company that knows how to market to the mainstream and is willing to buy it out. The high number of Israeli firms that have taken this measure serves as evidence of its worthwhileness.

If the firm has financial means, it can "hibernate" or activate a "keep on moving" strategy. The choice between these two options depends on the managers' estimation of the size of the communications break between the early and mainstream markets, or in other words, the "ripeness" of the mainstream market for accepting the new technology. If the break is not large, it is reasonable to assume that by making changes in the product and its marketing channels in an effort to adjust it to the mainstream market, and by creating a

marketing mix that responds to the needs of the mainstream consumer, it may be possible to get through the saddle successfully. Even without performing precise calculations, it appears that the "flitting" strategy has less to recommend itself due to the initial high investment required for a reentry into the marketplace.

Other implications of the results of our study touch on investments in start-ups, among them if R&D investment is with state funds, e.g., those of the Chief Scientist of the Industry and Trade Ministry, or with partial underwriting such as by the Inbal Foundation, or investing with funds that are not public, but rather directly in the firm, e.g., a venture capital fund (see for example Ber 2003; Trajtenberg 2001; Kamien, Muller, and Zang 1992).

Firstly, the question is whether to invest more money (second-round financing) in a start-up whose sales show a downward trend. This question is similar to the dilemma of whether to kill a product. The answer to both these questions depends on the nature of the downward trend. If the firm finds itself at the brink of a saddle, then Herculean efforts to change the product and appeal to the mainstream market may rescue the product and the firm. Based on the makeup of the firm's clientele, it is possible to tell whether the firm is on the brink of a saddle or on the brink of a fatal fall in sales. If most of the firm's customers still belong to the early market, then the firm is on the brink of a saddle, and there is still a chance to rescue it.

Secondly, in light of the datum that emerged from our survey that a large percentage of firms experience or have experienced a saddle, and in light of the difficulty of Israeli firms of serving the mainstream market population (that is mainly foreigners) and surviving a saddle, the question arises whether state investment toward creating jobs in this way is an efficient policy. This question is important also in light of the fact that Israeli start-ups tend to choose the "seek a home sweet home" strategy in which, when the yreach a saddle, they go out and look for sponsorship and to merge with a larger firm.

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