Collect now - Consume later
On Innovative Products in Electronic Commerce

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Abstract

In our paper we develop the idea that in the future electronic commerce will increasingly involve customers whose lack of time for consumption forces them to collect the products they purchase for later consumption.
The peculiarity of these conditions at the point of sale will be discussed in detail from the perspective of economic theory. The analysis will elaborate how certain characteristics of utility functions as well as other characteristics of this consumer segment contribute to these peculiarities.
As a result some lessons for the timing of innovations in the supply of information commodoities are derived. In particular it is shown why it might be profitable for suppliers in electronic commerce to produce waves of technological fashions. From a theoretical point of view it seems to be reasonable to use chaotic dynamics to describe this highly volatile market behavior.

Keywords:

Consumer behavior; Technological fashions; Chaotic dynamics

Introduction

Consumer behavior and its implications for the supply side have been studied extensively though from rather diverse perspectives in several sub-disciplines of economic theory.

Standard microeconomics lays its emphasis on the investigation of the logical implications of certain axiomatic assumptions on given preference orders. Though some of these implications have been tested by experimental economists - with varying results - the thrust of theory building in this area remains in the realm of abstract theorems of decision logic (see e.g. [1]).

More *applied economic theory* of consumer behavior tended to differentiate between the different approaches that have been taken to study it (see e.g. [2]). In particular, a motivation approach, a single-concept approach, a grand theory approach, an information-processing approach, an affective approach and an experiental approach are distinguished and discussed by different scholars in the field. What is especially important in applied economic theory is that the demand side behavior of consumers is seen as part of an interdependent system which involves supply side actions and the development of macro-variables that feed back into micro-decisions too. Nevertheless applied economic theory - at least in its academic reputation - still suffers from the missing of some more unifying concepts that some researcher feel to be necessary to structure the existing set of aspects.

Finally research rooted in *managerial economics* has contributed to the study of consumer behavior. From the point of view of a single firm consumer behavior is of utmost importance for its marketing strategy (see e.g. [3]). Two ideas figure prominent in this literature: First, some products seem to follow a so-called *product cycle*, i.e. demand for these products emerges, grows and finally vanishes again. Second, demand can be influenced massively by the use of *information policy*, i.e. consumers use mental models to determine their product choices - and these models are open to manipulation. Managerial economics has also produced a more algorithmic view to describe consumer behavior as a sequence of actions, the so-called *stages of consumer buying behavior*: need identification, product brokering, merchant brokering, negotiation, purchase and delivery, product service and evaluation. This sequence is particularily useful to identify the place of a certain theoretical distribution in this sequence.

Given this largely diverse strands of theories of consumer behavior, what follows focusses on a special part of consumer-supplier interaction, a part that seems to be of particular interest for electronic commerce - and uses bits and pieces of the mentioned schools, wherever it seems to be appropriate. In this eclectic way, the next section uses microeconomic techniques to formulate something analogous to a product cycle, while the succeding chapter lays emphasis on expectation formation to introduce demand-supply interaction. Finally some empirical evidence for the relevance of our model will be given.

As will be noted, our model in principle covers all stages of consumer buying behavior though it does not go into the details of brokering ad negotiation. In this respect our particular interest is the challenge to cope with a special

type of needs and the reaction this type induces on the supply side.

Theory

We first characterize the group of consumers we want to describe in an informal way: Consumers in the segment to be highlighted are characterized by the the following specific features:

- The utility they derive from consumption consists of two, analytically distinctive future consumption periods: a period in the near future, called *immediate consumption*, and a period in the more distant future, called *latent consumption*.

- Immediate consumption is the part of consumption necessary to satisfy the needs of the physical metabolism of a consumer. It includes everything needed for *enduring physical and mental reproduction* of the consumption unit, i.e. eating, housing, clothes, services like job training, child care and the like.

- Latent consumption consists of those goods and services that are *not essential for immediate reproduction*. In what follows only those commodities for latent consumption that are *information commodities* are considered. The reason for narrowing the focus is the observation that due to electronic commerce the share of information commodities in latent consumption increases.

- *Information commodities* are commodities, which can be represented as a bit string.

- Consumers are thought to be *rational and well organized* with respect to their *immediate consumption*. In particular, they are assumed to allocate time in the immediate future in a way that combines working time and immediate consumption time by the use of a schedule ensuring their metabolism.

- Assume further that *labour productivity* of the consumers in this segment *increases* while *immediate consumption* becomes *cheaper*. With fairly developed market mechanisms this implies that for given working time more income becomes available than can be spent in the remaining time for immediate consumption[1].

- *Excess income* is spent for latent consumption, in particular for latent consumption of information commodities.

- The utility attributed to latent consumption acquires the status of a *symbolic value*. It derives from the imbalance between the more intensive working time which is not balanced by an adequately increasing immediate consumption. The growth of the latter clearly is restricted and will have to be supplemented by a *believe in consumption* in a more distant future - latent consumption.

- Nevertheless the consumers in this segment are consumers and not investors, they *store the symbolic value* in consumer goods, in particular *in information commodities*, and not in investment goods, i.e. assets.

- Assume now that consumers are much less rational and well-organized with respect to their latent consumption than with respect to their immediate consumption. And they are so precisely *because* they are rational: Beyond a certain amount of latent consumption they do not want to spoil the symbolic value of their acquisitions. A rational assessment of their actual time spans available in the distant future for the transformation of latent into manifest consumption would reduce current symbolic value - so it is *rationally avoided*.

  Let $u_C^L(c_L, s_L)$ be the current utility u_c^L, of latent consumption c_L, given a certain structuring strategy s_L. Assume further that only two structuring strategies are considered: The first one is 'do not use a schedule to structure consumption', expressed as $s_L = 0$, and the second one is 'use a schedule to structure consumption', expressed as $s_L = 1$. Define in an analogue way the utility of immediate consumption as $u_c^M(c_M, s_M)$. Now the propositions made above simply can be expressed as:

  $$u_c^M(c_M, 0) < u_c^M(c_M, 1)$$

  for immediate consumption, and

  $$u_c^L(c_L, 0) > u_c^L(c_L, 1)$$

  for latent consumption. Note that the deeper reason for these relationships is the fact that immediate consumption permanently has to stand the test of transition of planed c_M to manifested c_M, whereas for latent consumption this test is permanently postboned.

- Symbolic value of information commodities for latent consumption thus obeys laws rooted in the symbolic interaction of consumer groups, i.e. there exist pure (information commodity) fashions. This is the starting point of the model of the next section.

[1] There is a clear limit of daily eating and drinking, and you cannot live in your house more than 24 hours a day. Even with some adjustment for quality of immediate consumption commodities, satisfaction levels are bound to be meat - this is the point were symbolic values emerge.

High Income – No Time: A model of a demand segment

Assume now that the consumer group under consideration consists of a fixed number of individuals, call this number n. If a new information commodity is offered to this group, there will be a certain number of individuals that will have bought it at a certain point in time, name this number h_t. Now consider the expected symbolic value attributed to the possesion of this good. Since it is not expected consumption c_L alone, but also the possibility to communicate the fact of possessing the good to other individuals in the consumer segment, who do not possess it yet, from which utility is derived[2], a natural way to formalize this is the following:

$$E(u_c^L) = c_L \cdot \frac{n - h_{t-1}}{n} \qquad (1.1)$$

What this expression says is that c_L has to be multiplied by the probability that the next person the individual communicates with does not already possess this good too, to arrive at the expected symbolic value of this good. Note that since this expectation process takes place before the point of sale, what (1.1) implies is that the next person could well be the individual itself, i.e. there is self-communication, the prospective buyer is a member of $n - h_{t-1}$.

If the current price of the good is exogenously given as p_c^L, then consumers will buy as long as $E(u_c^L) > p_c^L$. Furthermore it is only straight forward to assume that the number of individuals possessing the good will rise according to the excess of expected utility over price:

$$h_t = h_{t-1} \cdot (1 + (E(u_c^L) - p_c^L)) \qquad (1.2)$$

Inserting equation (1.1) into (1.2) gives

$$h_t = h_{t-1} \cdot (K - \frac{c_L}{n} \cdot h_{t-1}) \qquad (1.3)$$

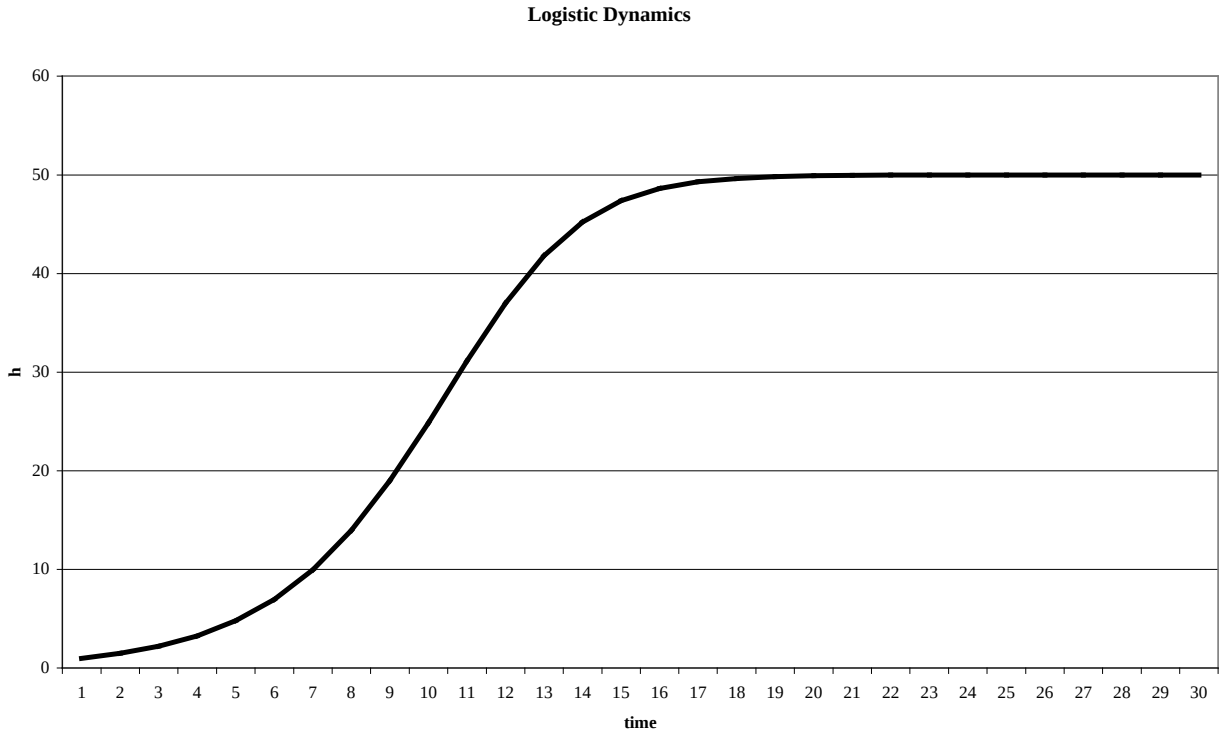
$$\text{with } K = 1 + (c_L - p_c^L).$$

Evidently this is a variant of the well-known logistic equation also used in theories of the product life cycle, though the argument there is completely different from the one here. It can produce a variety of dynamic behavior of h_t, the first variant is shown in graph 1.

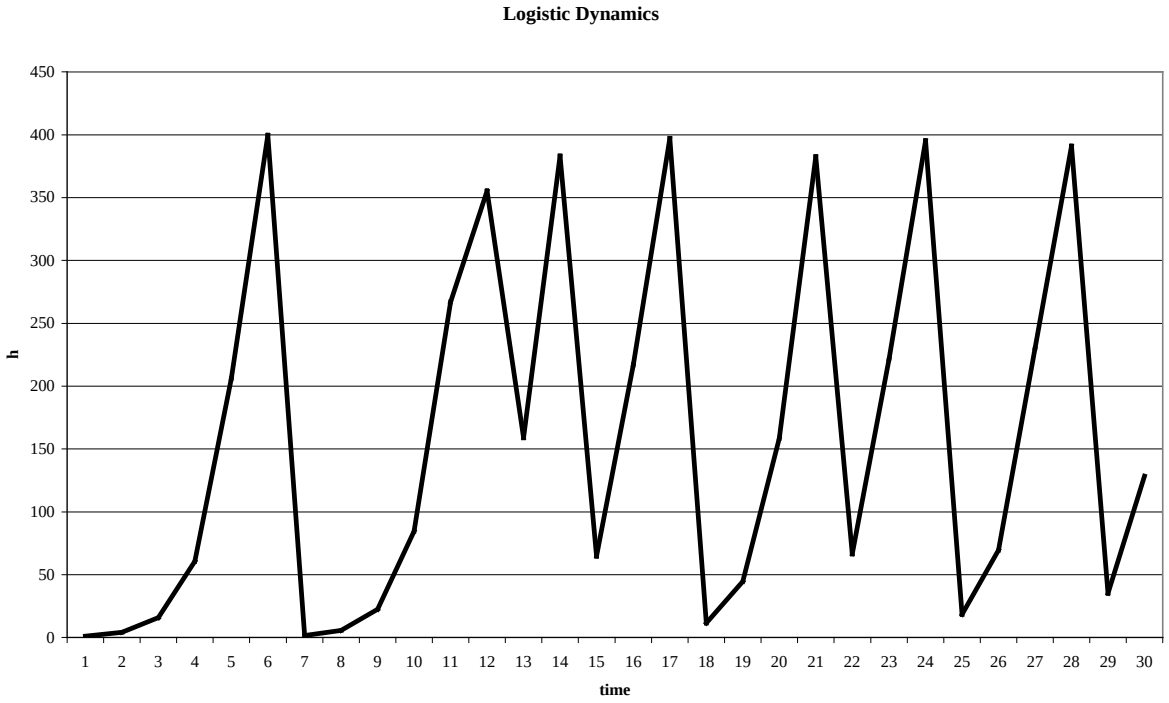
The values assumed here are: $n = 1000, c_L = 10, p_c^L = 9.5$, and the initial state is that only one individual possesses the good. The dynamic behavior of h_t for 30 periods in graph 1 shows that after a slow introductory phase there is a run on this good that finally levels of at a level of 50 individuals possessing it. It might be considered as a remarkable fact that in this setting only 5% of the potential consumers actually end up buying. To get an idea if this situation can be improved, and to exploit the rich dynamics of logistic equations a little bit more, let us take a look at graph 2, where now $p_c^L = 7$, and everything else is left as it was.

[2] This idea was not present in the utility functions in the preceding section, because there it was not necessary for the formalization of the argument.

Graph 1 - High Price



Graph 2 - Low Price



The surprising fact is that the simple assumptions made above allow for the highly irregular deterministic behavior[3] shown in graph 2.

The wild fluctuations observed stem from the fact that nothing in equation (1.3) hinders consumers from re-selling the good[4] as soon as the term in brackets becomes less than one. In a sense this is what might happen if electronic auction markets with private participants function perfectly! But observe also, that at times the percentage of consumers owning the product goes up to 40% (as compared to 5% in graph 1). There seems to be a trade-off between high average level of demand and smooth increase of demand.

This leads to the following final consideration: If re-selling possibilities are not perfect, more precisely, if only a certain percentage, δ, of the existing owners of the product are able to re-sell, then producers are able to exploit this trade-off. In the following graph 3 the ratio λ is taken to be 0.2, everything else again unchanged.

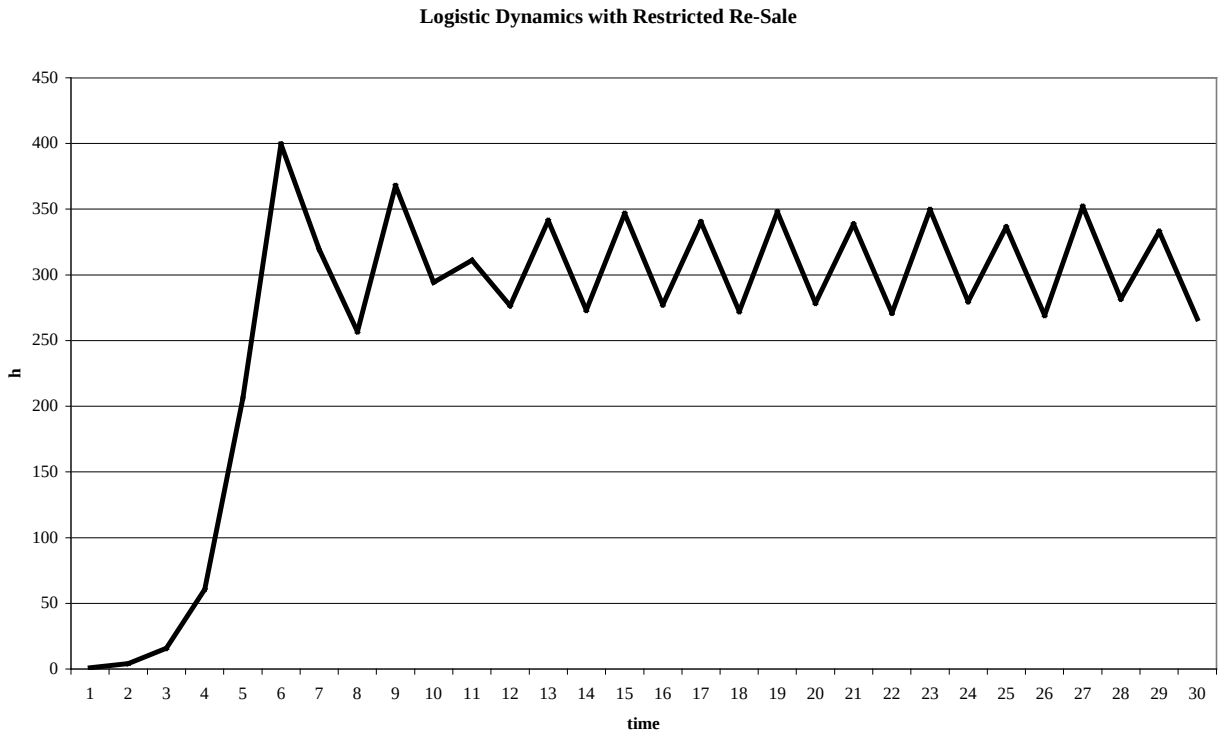
As this diagram shows there seems to be the possibility to keep demand at a level of 30% (with some fluctuation of of plus or minus 5%) if re-selling is impossible for 80% of the individuals.

Even these few examples show the potential of this type of analysis to picture a rich variety of empirically observed behavior in markets that exhibit the characteristics assumed above. But before turning to empirical plausibility we will discuss possible supply side reactions.

[3] As the mathematically inclined reader will have noticed this stems from the fact that the logistic equation is the simplest functional form that lends itself to chaotic dynamics.

[4] Indeed the notion of re-selling is problematic since in this first formulation it is assumed that the buyers of resold goods are exogenous to the model. Further elaboration will be needed take care of this problem.

Graph 3 - Low Price with 20% re-selling ratio



Actual and Expected Product Properties: the point of sale

In response to the dynamics shown in graph 1 it is obvious that suppliers of information commodities will direct special efforts to the introductory phase to increase the critical mass of owners in the beginning, which is responsible for slow take-off. The analogue is true for the final phase, when not much can be gained anymore since demand reaches its upper level[5]. Indeed money spent on the promotion of an information commodity in its final phase can be taken away and used to start-off a new product.

In graph 4 these obvious strategies of producers are shown. Indeed the argument can even be taken a little bit further: If producers know about the whole cycle and if products are substitutes - which in this segment is always true since actual consumption considerations are irrelevant - then producers should use easily conceivable signs for dating their products to force consumers to change to the new product since sticking to the old ones would easily be noted by the others in the consumer segment. In other words, the producers will promote waves of (information commodity) *fashions* (compare graph 4).

In this graph the same parameters as above, but now with $p_c^L = 9$ are used. New commodities are assumed to be introduced when revenues of the old commodity reaches its maximum. In the example this takes on the form that one new commodity with a price of 9 is given away free to a first customer in the period when revenues reach 224. Obviously there is more room to smoothen revenue streams by wise donations.

Return now to the question of information production and the point of sale. From a microeconomic point of view the answer is pretty obvious: The point of sale will be reached if

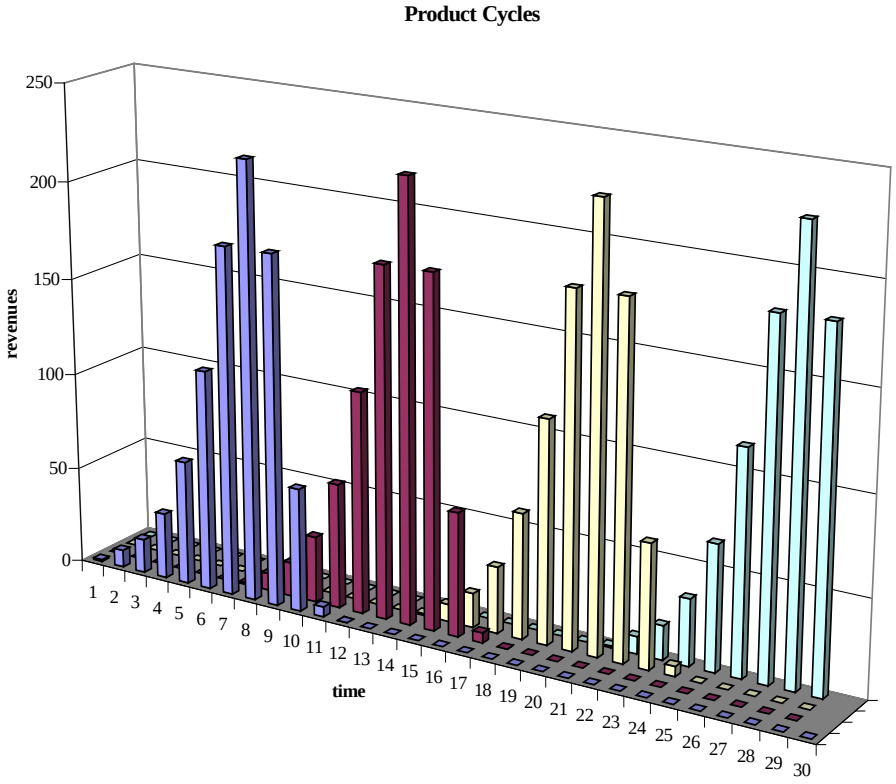
$$E(u_c^L) > p_c^L \qquad (1.4)$$

is conceivable for the consumer. Taking a closer look at the left side of this inequality shows two principle routes that can be taken to increase the utility the consumer expects: First, one can try to increase $E(c_L)$, the expected value of the commodity itself, and second the producer can try to influence the consumer's observation of the macro-state.

With respect to $E(c_L)$ all kinds of illusions of future utility that will be accepted by consumers can be used, the limit is not set by actual consumption but by trustworthy - compare SF-stories accompagning market campaigns in the area. Another commonly used possibility is to point at extremely high opportunity cost that will appear if the commodity is not bought right now - the threat is that in the future it will disappear from all markets. For information commodities this threat rapidly looses credibility as consumers become aware how easy and cheap it is to store large amounts of information.

[5] Note again that this level might be considerably smaller than the total potential of the segment.

Graph 4 - Fashions of Information Commodities



The other route is to influence the observation of h_t and n. If the consumer thinks that h_t is lower than it actually is and that n is higher than it actually is, then the salesman has manipulated the consumer closer to the point of sale, compare (1.1) and (1.4). Translated into marketing language the consumer has to be convinced that less people already possess the new commodity than actually do, and that more people would like to have it than actually do - and that is exactly what salesmen in the area do.

Without going into algebraic details it seems to be reasonable to assume that costly manipulation work will mainly occur in the introductory phase of the product. For two reasons. First, at this point money from revenues is affluent (see graph 4) and second this period is critical for fast take-off. Manipulation work will be extended as long as expected profits from this activity remain higher than its cost - at least this is the standard microeconomic argument. The most difficult task in these efforts evidently is hidden in this argument: It is extremely hard for producers to anticipate how far away from the points of sale, and as a consequence from take-off, they are. So they usually cannot make good estimates about their necessary manipulation cost. This fact works in favour of large producers who can afford larger forecasting mistakes, errors which would drive smaller firms immediately out of business.

We have come a long way now from our simple behavioral model of a certain consumer segment. Let us now turn to some empirical evidence for our case.

Empirical Plausibility

It is rather difficult to investigate directly if the above made assumptions on the behavior of a certain consumer segment are emprically observable. This is so, because they involve some psychological mechanisms, which will be severely disturbed if the person applying them notices that it is observed. Partly sub-conscious mechanisms are a typical example of observer interference - as soon as an interviewer starts to asks questions, part of the original behavior is destructed[6]. What remains are some generally observed facts in the area of EC consumer behavior that seem to support our suggestions at least indirectly.

- To identify a group of consumers that bears some similiarity with the one implicitely assumed in the consumption segment considered in this paper is not too difficult. Most authors dealing with the empirical side of consumption of a future 'information society' in one way or the other come up with the prediction that there will be a group of well-educated people with high earnings and an overload of work. And this group is opposed to a group with exactly the opposite characteristics. The first group will be small in numbers, but will contribute a large share of effective

[6] Of course, several interviewing techniques have been constructed to overcome this problem, but it still must be doubted that the additional impact of these tricks is small enough to be neglected.

demand, while the second group will be large and poor. This will be particularly true for demand for information commodities. Thus with respect to the households articulating this type of demand, there is indirect evidence of their existence.

- The second type of indirect evidence relates to EC-products: How well do the major product groups traded fit in the model given above? First of all, it is obvious that the largest contributions to EC comes from trade with information commodities - commodities that can be transformed into bit streams. These not only include music and text, but all types of (electronic) consultency and the like. The 'old economy', as it is sometimes labeled, increasingly uses electronic devices, but its contribution to EC still is dominated by EC in information commodities. Within the group of information commodities the most attraction seems to be exerted by those commodities promising entertainment[7], i.e. sex, music and books[8]. Since sex mostly comes in the format of pictures (of 'galeries'), text and music as CDs (or nowadays as MP3-files) all three top commodities are particularly suitable for the arguments in our model: collect them. Moreover it is also evident that looking closely at pictures, reading texts and listening to music is time consuming - time that people who extend their working day to the limit do not have: buy now, consume later. Indirect evidence thus indicates that the relative importance of information commodities fitting into our framework within all sorts of demands exerted by the consumer sector identified in the last paragraph is high and still growing.

- Third consider suppliers' reactions. Again the creation of fashions and technological hypes can be considered as one of the major marketing techniques in the area, indirectly proving the appropriateness of our model. At this point Hal Varian's discussion of the so-called 'experience goods' sheds some additional light on our case [5, pp.5-8]. Experience goods are goods that consumers must experience to value them. If you only collect them, then the price you just paid cannot be contrasted by the value you attribute to them through experiencing them - instead you can always adjust your expectations of future experience to justify the current price you paid. Suppliers who are well aware of these processes need not care too much about the quality of their merchandise; all they have to worry of is their brand name, their reputation.

Of course, many other explanations could be given to these empirical observations too, but the model described above still seems to provide a particularly consistent theoretical view that explains them.

[7] An emphatic argument for this simple observation is given by Paul Saffo [4].

[8] Note that if one considers 'books' as 'drugs', then we are back to Mick Jagger's famous declaration of contemporaneous utility maximization: 'sex and drugs and rock'n roll'.

Conclusion: Some Lessons for the EC-Community

For the analysis of electronic commerce the lessons from our approach appear to be threefold:

First, the standard model of microeconomic theory as well as the standard marketing model seem to miss an essential part of what is going on in this field. It needs a new approach, and what we propose is our best guess.

Second, for an ever larger part of effective demand in industrialized countries the needs directly related to the physical metabolism become less and less important. Economic psychology, sophisticated expectation models and the like become more and more relevant. Discovering these mechanisms is vital for any successful EC-strategy of a supplier. Note also that the growing mass of households whose demand is not effective demand, i.e. they do not have money or just money in rapidly devaluating currencies, easily can transform the economic problems of EC into political problems - a broader approach, say 'electronic political economy' (EPE), might thus be wise.

Third, the behavior of the mechanisms we study is highly volatile, and we regard this to be an adequate feature for the description of EC-markets. It results in waves of hypes and breakdowns - in the markets themselves as well as in the stock prices of the concerned firms. From a theoretical point of view the use of chaotic dynamics seems to be adequate, and we just gave the simplest example. One would like to see more of this.

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