PSYCHIC STOCK: RETAIL INVENTORY FOR STIMULATING DEMAND

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Abstract

The supply-side or demand-servicing functions of inventory are well-known in the inventory, logistics, and retailing literature. However, this literature has yet to develop the demand-stimulating function of inventory. This paper introduces the concept of psychic stock, which is defined as retail inventory for stimulating demand. Operationally, psychic stock is measured as total inventory on hand minus the sum of cycle stock and safety stock. The consumer behavior theory is drawn upon to offer possible explanations for the impact of psychic stock on sales.

Introduction

Marketing channels and retailing literature does not recognize that inventory levels impact sales. While "quick response" retail technology reduces lead times (Miller 1987) and supply-side (cycle, in-transit, and safety) stock (Larson and Lusch 1989), a minimum level of (psychic) stock must be on the shelf to stimulate demand. Traditionally, marketers have recognized only the demand-servicing or supply-side aspects of inventory (Hardy and Magrath 1988; Lele 1986). In contrast, psychic stock is inventory that the retailer carries to stimulate demand. The psychic stock concept extends the shelf-space effect by making it explicit that stock level, as well as shelf space allocation, impacts sales.

Early writing on the shelf-space effect (Pauli and Hoecker 1952), gave rise to a rich stream of research into the relationship between shelf space and sales (e.g. Cairns 1962; Curhan 1972; Bultez and Naert 1988). However, the following two gaps remain in the shelf space literature: (1) the shelf-space effect has not been integrated with the impact of stock level on sales, and (2) shelf space research has yet to offer causal explanation of the effect of space (and stock) on consumers.

An early study on stock level, sponsored by Progressive Grocer, concluded that "substantially higher sales can be achieved merely by keeping grocery shelves and refrigerator cases fully stocked throughout the week" (Mueller, Kline and Trout 1953). A literature search uncovered only one article which conceptually recognizes the impact of both shelf space and stock level. Crouch and Shaw note that low stock levels are "likely to reduce exposure to the consumer and therefore may lead to a reduction in sales" (1989, p. 7).

Previous considerations of shelf space are mostly based on economic models of shelf space elasticity. The economic models assume that consumers are guided primarily by their perception of the size of shelf space allocation. However, consumers also may make attributions about the stock levels they perceive. For example, if the shelves are poorly stocked, consumers may feel the product is old or has been picked-over by previous customers. An inquiry into consumer behavior aspects of stock level can lend causal explanation.

This paper introduces the concept of psychic stock. In the first section following, inventory classification theory is briefly reviewed. Next, psychic stock is identified as a new, demand-side inventory category. In the third section, an inventory model with psychic stock is developed. Then, the results of inventory item case studies are reported. Lastly, consumers' perceptual, attributional, and individual differences are detailed as potential causal agents for the psychic stock phenomenon.

Inventory Classification Theory

Quick response retail technology and item-level inventory analysis, like Direct Product Profitability (DPP), are exerting pressure to minimize inventory levels (Abend 1987; Schulz 1985). However, such efforts can lead to stockouts and lost sales (Thayer 1989). This conflict stems from the following typical inventory theory/modelling assumptions: (1) demand (or sales) determines required inventory levels to service that demand, and (2) inventory levels have no effect on sales.

Before adding psychic stock (inventory to stimulate demand) to current inventory classification systems, it is helpful to briefly review inventory classification theory. Leading textbooks in inventory management (e.g. Tersine 1988) and logistics (e.g. Stock and Lambert 1987) present classifications of types of inventory. Stock and Lambert (1987) identify the following categories of inventory: (1) cycle stock, (2) in-transit inventories, (3) safety stock, and (4) speculative stock. Tersine (1988) discusses a set of essentially synonymous categories, as follows: (1) working stock, (2) pipeline stock, (3) safety stock, and (4) anticipation stock. These inventory categories are described below, as they apply to a retail store.

Cycle stock in the retail store varies from zero to Q units (Q is the replenishment lot size), and averages Q/2 units. Stock and Lambert define cycle stock as "inventory that results from the replenishment process and is required in order to meet demand under conditions of certainty . . ." (1987, p. 399).

In-transit stock is inventory en route from the factory or distribution center to the store. Expected daily demand (r) divided by lot size (Q) is the number of orders arriving on an average day. Thus, average in-transit stock is: orders per day x order size x transit time (t), or $r/Q \times Q \times t = rt$.

Safety stock is inventory at the store "held in excess of cycle stock because of uncertainty in demand or lead time" (Stock and Lambert 1987, p. 400). If R is the maximum daily demand and lead time is certain, a logical policy would be to carry safety stock of: $t(R - r)$. Unlike probabilistic inventory models (see Tersine 1988), this assumption of known maximum demand allows safety stock to cover all demand. Thus, in the inventory model developed below, safety stock is overstated and psychic stock is understated.

Speculative stock includes additional inventory bought on deal (e.g. quantity discount) or acquired to support a special sales promotion. In demonstrating the existence of the psychic stock phenomenon, this first study looks at inventory items for which no special sales promotions are on. Also, this analysis is limited to items held at retail to service and/or stimulate current demand only. Any deal buying for purposes of diverting or satisfying future demand is not considered. Thus, speculative stock is not included in the model developed below.

All categories of inventory defined above are carried to service demand (Hardy and Magrath 1988). Marketers have traditionally viewed inventory as demand servicing only, i.e. inventory (the dependent variable) is a function of sales. In the next section, "psychic stock" is introduced as a new theoretical category of inventory -- and a retail merchandising tool to obtain or stimulate demand (see Exhibit 1).

EXHIBIT 1
TYPES OF STOCK IN THE MARKETING EFFORT

Marketing Effort

Obtaining Demand	Servicing Demand
- Personal Selling	- Warehousing
- Advertising	- Transportation
- Sales Promotion	- Order Processing
- Pricing	- Inventory*
- Merchandising**	

* includes Cycle, Safety and In-transit Stock
** includes Psychic Stock
Adapted from Hardy and Magrath 1988, p. 215

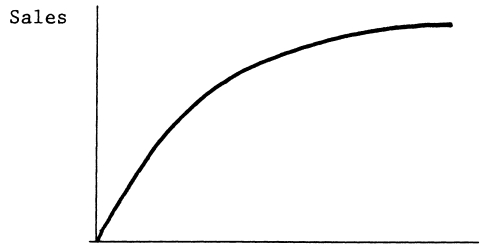
Psychic Stock

Psychic stock is inventory carried to stimulate demand. Conceptually, this turns the inventory/sales relationship around; now sales is the dependent variable. Operationally, at the retail level, psychic stock can be measured as that level of inventory above cycle stock plus safety stock.

The exponential relationship between shelf space allocation and sales of an item is well-known. For instance, Cairns notes that "the sales of an item in a store will increase (at least up to a point) with an increase in the amount of space allotted to it, and/or an improvement in the quality of the space" (1962, p. 36). Crouch and Shaw (1989) discuss a similar relationship between stock level and sales.

The inventory flow model shown in the next section is the first step in formalizing this relationship (see Exhibit 2). In this paper, the model is used to direct case discussions with retailers to demonstrate the existence of psychic stock.

EXHIBIT 2
THE PSYCHIC STOCK CURVE



Inventory Model with Psychic Stock

Exhibit 3 (available from the authors) is a diagram of the inventory flow model. Inventory is expected to vary from a minimum equal to the psychic stock level to a maximum equal to psychic stock (PS) plus safety stock plus cycle stock. If lead time (t) is certain, and safety stock is held to cover maximum expected demand (R), then upon arrival of a replenishment lot of Q units, total inventory on hand (I) is: $Q + t(R - r) + PS$, or

$$PS = I - [Q + t(R - r)] \qquad (1)$$

Case Studies

Visits were made to several Norman, Oklahoma retail stores to demonstrate the presence of psychic stock. Four health and beauty items were investigated in three different stores. These items are labelled A, B, C, and D in Table 1, which applies equation (1) to data estimated during interviews with retail managers. For each of the four items, psychic stock was found.

TABLE 1
PSYCHIC STOCK FOR FOUR ITEMS

Item	I	Q	t*	R**	r**	PS
A	27	12	1.0	6	3	12
B	113	60	0.5	180	120	23
C	27	12	0.5	24	18	12
D	40	-	-	-	-	27

* in weeks
** in units per week
I, Q and PS given in units

In the case of item A, 12 units (the psychic stock level) is also the planned minimum level of inventory to have on hand. Item B is displayed in two places: (1) at the eye and waist level, and (2) on the "high wall," which is out of the consumer's reach but not out of the consumer's view.

For item C (like item A), the retail manager spoke in terms of minimum desired inventory level (8 - 10 units in this case). While the item D manager was reticent to discuss lead times and demand rates, psychic was none-the-less evident. Of the 40 units of item D on hand, 15 units were "on top," for display only and the remaining 25 units included 12 units of "suggested (minimum) quantity" stock.

In all cases the retail managers recognized the demand-stimulating function of their inventories -- in addition to the traditional demand-servicing function. At the end of each day all the stores have a policy that all items are "faced-up." This means to pull the inventory to the front of the shelf to make it appear that the shelf is fully-stocked. This is evidence that the demand-stimulating effects of psychic stock are deeply ingrained in accepted merchandising practice.

Alternative Explanations of Psychic Stock

In the 40-year history of shelf space literature, there has been little attempt to offer causal explanation for the shelf-space phenomenon. To date, every study has been descriptive in that these studies either tried to prove that the shelf-space effect existed or tried to quantify it. Further, the focus has been on space only, to the neglect of stock level. In this section, some possible consumer behavior "whys" for the psychic stock phenomenon are suggested.

Since the consumer makes the purchase decision, consumer behavior theory should provide potential causal explanations of the psychic stock phenomenon. The shopping experience varies considerably depending upon the consumer's level of awareness and the degree to which thought processes are "on-line." Shopping for commonly used grocery items likely involves much automatic processing, while shopping for outer-wear clothing is likely to be both on-line and high involvement. In addition to the level of awareness, individual differences are likely to mediate the shelf-space and psychic stock phenomena.

Picture a shopper in a large department or discount store that carries merchandise ranging from every day use items (e.g. soda pop, hand soap) to high involvement items (e.g. compact disks, sweaters). The shopper moves through the store operating with much of his/her cognitive power off-line, operating under either a general shopping script or a store-specific shopping script. At this point, the merchandising/person interaction is largely automatic, with stimulus perception being the only processing. Any purchase decisions made at this level of processing utilize the simplest and most basic heuristics.

If the script is interrupted, the person shifts toward on-line awareness and attributional processes (Fiske and Taylor 1984). This shift may be due to some salient merchandising effort, such as point-of-purchase signing or a novel or vivid display. The consumer is now using more complex heuristics or even conscious reasoning. With increasing on-line awareness, the consumer is increasingly making attributions about the stimulus. For psychic stock, the consumer is attributing the mass of a particular product to something. Perhaps because there is a large mass, the consumer believes the item is "on-sale" or is a popular, fast-seller.

In addition to perception and attribution, individual differences will impact what attributions are made and what heuristics are used. In summary, the three general categories of explanations for psychic stock are perceptual, attributional, and individual differences. A list of possible explanations for the psychic stock phenomenon, arranged in approximate order from perceptual/off-line processing toward more on-line/attributional processing, follows.

Minimum Perceptual Threshold. Weber's research in the middle of the 19th Century suggests that there is some required minimum level of a stimulus before that stimulus is noticed. Although Weber's concept dealt with simple stimuli without interference from other stimuli (e.g. seeing a candle at 30 miles), the concept is transferable to an in-store merchandising situation. Thus, in the midst of other products, the shopper may never notice one facing of a particular product even if that facing is fully-stocked.

Random Chance. Simply by there being a larger mass of goods the chance of seeing a particular product may be increased.

Just Noticeable Difference. Many of the shelf space experiments lasted only a week (e.g. Cox 1970). Thus, some of the reported effects may have been due to the change in mass, rather than just the absolute size of the mass. Weber's Law (JND = delta I = C x I) states that the change in intensity of just noticeable difference (JND) is proportional to the intensity of the stimulus (I). This suggests that the incremental increase required to interrupt a script can be quantified as JND.

Fechner's Law. This law states that the strength of a perception (S) grows as the logarithm of stimulus intensity (I), or S = k x log I, where k is a constant (see Kaplan and Saccuzzo 1989). A graphical model of Fechner's Law would have a concave shape somewhat like that in Exhibit 2. Fechner's Law suggests that: as the amount of psychic stock increases, the incremental effect on the individual will decrease.

Steven's Power Law. Fechner, like Weber, deals with differences in stimulus intensity. In contrast, Steven's Power Law deals with human identification of magnitude. Steven's Law is given by the equation:

$$S = b \times I^{a} \qquad (2)$$

where b and a are constants. A graph of this equation would yield a concave curve with a shape somewhat like that in Exhibit 2. Because Steven's Law deals with magnitude estimation (rather than estimated increases) the psychic stock effect may follow Steven's Power function

rather than Fechner's log function.

Active Offer. In a more attributional sense, the more on-line consumer may see the large display as an overt or active offer by the merchant. After all, the merchant must have some reason for featuring so much "Tide" laundry soap.

Appropriateness. The consumer may attribute a large mass of merchandise to the fact that this is newly arrived merchandise. Depending on the type of product, the consumer may make attributions about seasonality (e.g. "It must be peach season"), freshness (e.g. "This bread must be fresh off the truck"), or fashion (e.g. "This group of suits must be the latest design").

Special Deal. This attribution may be a special case of active offer. Here, the consumer attributes a mass of merchandise to a special sales deal, and may buy on impulse. Even if the consumer knows the regular price, and realizes the merchandise is not on sale, his/her attention has been captured momentarily. Thus, s/he may ask: "Am I out of coffee at home?" -- and the sale may still be made.

Consensus. The consumer may attribute the mass of a good to its popularity among other consumers. Most consumers probably suspect that a merchant stocks more volume of high sellers. If the consumer has low brand preference, s/he may choose the brand that others apparently prefer.

Individual Differences. These factors, ranging from long-lasting personality traits to relatively short-lived attitudes, are likely to mediate perceptual and attributional processes. For example, persons who are highly susceptible to interpersonal influence may have a stronger tendency to make use of consensus attributions.

Other Potential Mediators. These include product type, consumer involvement, store atmosphere, location within the store, and shelf height of the merchandise. Product type is an intuitive candidate mediator. Who wants to purchase the last doughnut at the bakery, or the last dress on the rack?

Establishing the causes of the psychic stock phenomenon from a consumer behavior perspective will be a major task. There are many causal candidates, and interactions between candidates are additional candidates. Also, psychic stock is likely to interact with other in-store promotions, such as point-of-purchase signing and price promotions.

Summary and Conclusions

This paper has defined psychic stock, identified its existence, integrated it into inventory theory, and offered possible causal explanations. Future research should be pursued along two parallel paths -- inventory modelling and consumer behavioral modelling.

Future work could include mathematical modelling of the functional relationship between unit sales, psychic stock level (see Exhibit 2), and other in-store variables such as item price and promotion. Unit sales are expected to increase (up to a point) with: (1) a decrease in price, (2) an increase in promotion, and (3) an increase in psychic stock level.

Further psychic stock research should also include consumer behavior lab experiments. Slides or videotapes might be used to simulate a shopping trip through a store where each subject has a limited budget. Different subject treatment groups would see different stock levels, and the psychic stock effect would be measured by subjects' mock purchases.

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