

**Reducing Forward Buying through Derivatives**

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Submitted to the Engineering Systems Division  
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**ENGINEERING SYSTEMS DIVISION**

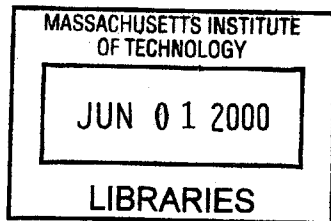
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# **Reducing Forward Buying through Derivatives**

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Master of Engineering in Logistics

## **ABSTRACT**

This thesis examines the potential reduction of speculative inventory, commonly known as “forward buying”, through the use of derivatives options, similar to those used on commodities exchanges. The reinforcing cycle of overbuying on promotion, which leads companies and industries into inescapable cycles of capacity excess & shortage, is explored and a framework for breaking free through the sale of call options on promoted products is proposed. Further speculation on the relevance of derivative instruments to Internet Exchanges and Collaborative Planning, Forecasting and Replenishment (CPFR) is advanced.

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## **AUTHOR'S NOTE**

The production, distribution, and inventory carrying inefficiencies created by forward buying are undoubtedly a supply chain management issue which impacts the entire consumer goods trade channel. In writing this paper, I have come to understand that this supply chain management problem requires a solution with a host of marketing, financial, and strategic components. This reinforces a key learning for me in my year at MIT:

Supply chain management is *not* simply understanding how to optimize a company's product flows through space and time and reduce their capital assets to their bare minimum. It is about examining the business dynamics *across the entire channel* and understanding which tools, be they activity based costing, dynamic pricing, or strategic partnership, should be used at which place in the channel to alleviate symptoms felt miles, and perhaps even months away from their original cause.

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# 1 INTRODUCTION

Buying at a low price and selling at a high price is a simple, ancient, prescription for generating profit. Similarly simple and old is the economist's law of an efficient market price as a function of supply and demand. Together, these two axioms indicate that, to profit, one must buy when/where supply is high or demand is low, and then sell when/where supply is low and demand is high. Without adding value through modification, or influencing supply and demand, moving a commodity through space and time (logistics) is the only way to generate a profit.

In the most basic of consumer goods value chains (materials supplier, manufacturer, retailer, consumer), the retailer performs this logistics function by moving product from the centralized location of manufacturers' plants or distribution centers to the decentralized communities. As a result of changing styles, improving technology, or biological deterioration, most consumer goods, such as foods, apparel, and electronics, are "time sensitive". In short, value is being lost, not added, by moving the commodity through time.

Looking at the value chain from end to end, then, it is safe to say that the longer it takes an item to get to the end consumers, the less it is worth to them. This is interesting because, taking the value chain as a whole, the consumer's dollar is the only monetary input into the chain. Every materials supplier, manufacturer, and retailer receives their total income from that dollar. Putting these two thoughts together, it is in the best interests of everyone in the value chain to get the product to the end consumer as quickly as possible.

These two assumptions (product is "time sensitive" and the end consumer dollar is the only source of revenue) indicate that product velocity is in the best interests of every member of the value chain. This, however, is directly opposed to the common practice of forward buying, in which retailers and distributors take advantage of manufacturers' temporary price reductions to fill their warehouses with cheap inventory. Because prices to end consumers are not reduced, consumer demand does not rise and the retailers inventories are slowly drawn down through regular sales.

In storing large amounts of inventory, retailers and distributors impede product velocity through the supply chain. Assuming, again, that product velocity is in the best interest of the entire supply chain, this would indicate that forward buying is counter-productive.

This thesis will focus on the food and consumer packaged goods industry, examining why the practice of forward buying continues, given the logical conclusion above, and how it might be reduced or even eliminated through derivative mechanics not unlike those used in existing commodities markets. System dynamics, inventory, and options pricing models will be used to develop this idea. Finally, further applications of the derivative mechanics model to improved sales forecast accuracy and dynamic pricing will be suggested.

## ***1.1 FORWARD BUYING***

Forward buying is, at its most basic, purchasing more of a material than is required for consumption purposes in order to take advantage of a temporarily lower price. A domestic analogy would be the homemaker who buys three 5 lb. bags of sugar because they are “on sale” at the grocery store, even though one bag alone is likely to last for two months. In some industries, such as the food and consumer packaged goods (FCPG) industry, the practice of forward buying at the manufacturer/retailer level has been taken to such extremes that entire warehouses are dedicated to storing forward bought inventory.

Many have pointed out that forward buying is a rational reaction on the part of retailers to manufacturers’ policies of high-low pricing. High-low pricing is the practice of lowering the price of a product, product family, or even an entire brand over a period of time after which the price is raised, only to be lowered again at a later time. In such a system that gives rise to the opportunity for “arbitrage” (buying low and selling high for a guaranteed profit), retailers and distributors are simply filling a role that, according to free market theory, must be filled anyway. As Durk Jager of Procter & Gamble points out, forward buying won’t end without “improved systemic business practices”.

Ed Artzt (former chief executive of P&G) has called the practice “a monstrosity”. Patricia Sellers of Fortune magazine has termed it “The Dumbest Marketing Ploy”. Many have likened forward buying to a drug, citing a short-term rush followed by a let down, addictive qualities, and long-term debilitating effects. To expand this metaphor, manufacturers gain quick revenue through lowering prices (the rush) in flooding the channel with inventory, but then find their natural revenue stream gone as their prices return to normal and the inventory slowly moves through the rest of the downstream supply chain (the let down). The need to boost revenue during the let down period leads to further cycles of “loading” up the trade with inventory (the addiction), which drives inconsistent and unpredictable demand patterns, causing production and distribution inefficiencies (the long-term debilitating effects).

To establish the scope of the problem, in 1990 Buzzell, Quelch, and Salmon estimated that forward buying of “Nonperishable food-store products” added from \$930M to \$1.350B to distributors’ costs and from \$720M to \$1.584B to manufacturers’ costs. These costs were the result of maintaining excess production capacity and carrying higher inventories. They went on to estimate that 40% to 50% of inventories were the result of forward buying.

At the heart of forward buying, inventory is disconnected from end consumer demand and is treated as a financial tool to boost short-term revenues. The manufacturer incurs extra cost to push large amount of inventory into the supply chain for the purposes of maintaining market share and generating discounted profits. The retailer purchases and stores large amounts of inventory, incurring storage and handling costs, to reduce costs by taking advantage of the lower price. The manufacturer is paying for the excess capacity and funding the retailers increased costs and incremental profit.

## ***1.2 A DERIVATIVE MECHANICS ALTERNATIVE***

In a forward buying arrangement, manufacturers realize short-term sales volume boosts which can be used to temporarily defend market share or temporarily increase revenues, potentially maintaining/increasing the company's stock price. Retailers gain a lower cost of goods sold, increasing profit margin, potentially maintaining/increasing the company's stock price.

Besides the obvious loss of margin to the manufacturer, the costs involved in an infrastructure that enables this kind of buying is excess capacity, in terms of production or warehousing, on the part of the manufacturer and excess capacity in terms of warehousing on the part of the distributor/retailer, not to mention the capital costs of holding inventory on the part of both of them. From a financial perspective, the option of a lower price is offered and purchased at the cost of inefficient logistics. This leads to the question:

*Why does inventory need to enter into this equation at all?*

If manufacturers are willing to reduce prices for products over a period of time and if retailers are willing to pay up front for these lower prices, the same results would be achieved if manufacturers sold the promise of a lower price to the retailers. Put another way, retailers would be willing to pay money for the option of a particular price on a specified product at some point in the future or over some future period.

In agricultural markets, producers do not need to over-plant or build multiple storage silos in order to generate revenue by selling product at a loss. They can sell a call option (or buy a put option) on an exchange. Distributors of agricultural products do not need to build huge warehouses just to take advantage of current price lows brought on by a good harvest. They can buy calls instead. No inventory changes hands, no production spikes occur, and no competing producers steal market share by undercutting the price on the spot market.

Spot markets and derivatives markets (markets for the buying & selling of futures contracts, forward contracts, and options contracts derived from some sort of physical or financial asset) are traditionally associated with commodity goods, such as corn or oil. The degree of homogeneity lends the liquidity which is essential for the success of these markets. This would, at first, appear to be inconsistent with the highly branded products of most FCPG companies.

Branding is an effort to differentiate a product in a consumer's mind through advertising, product placement, and other marketing initiatives including pricing. Once product differentiation is achieved, a branded product is able to be priced at a premium, and its sales are less susceptible to price reductions from less well branded competitors. Well branded products, such as Procter & Gamble's Tide™ or Pampers™, have realized these benefits, allowing P&G to offer an "everyday low price" (EDLP) pricing structure that removes much of the damage caused by high-low pricing and forward buying.



Less well branded products which are unable to achieve differentiation, though, must continue to compete on price through high-low pricing policies. These policies lead retailers to treat these products like commodities, engaging in “arbitrage” by forward buying. Therefore, while the products are actually branded items, the pricing policies instituted by the manufacturers make them commodities. It follows, then, that if a product is a commodity, it may benefit from a derivative market to reduce risk and smooth the transfer of funds between buyers and sellers.

### ***1.3 THESIS OBJECTIVES AND ORGANIZATION***

The goals for this thesis are to:

1. Demonstrate the counter-productivity of forward buying to the value chain
2. Hypothesize the rationale for forward buying/ high-low pricing
3. Model the recursive cycle of forward buying/high-low pricing
4. Suggest that derivatives are a less destructive alternative for the supply chain
5. Qualitatively evaluate the proposed solutions effect on the model

Chapter 2 explores forward buying in the consumer packaged goods industry. Similarities and differences between forward buying and the “bullwhip effect” are discussed and the failure of efficient consumer response (ECR) to reduce/eliminate forward buying is considered. The hypothesized rationale for forward buying and high-low pricing is described. Current trends moving toward the enabling of the proposed solution are identified.

Chapter 3 uses mathematical inventory models and systems dynamics models to qualitatively model the forward buying/high-low pricing rationales which yield a recursive cycle. Quantitative models are not employed as the costs/benefits of this practice are as much strategic as numerical and should be evaluated holistically. At the end of this chapter, options pricing models suggest an alternative to this cycle.

Chapter 4 evaluates the potential of the model, identifies key enablers, discusses program implementation strategies, and points out weaknesses in the model. Finally, Chapter 5 summarizes the hypothesis and the results and suggests further applications of derivatives mechanisms in FPCG markets.

## 2.0 FORWARD BUYING OVERVIEW

In her 1992 article entitled “The Dumbest Marketing Ploy”, Sellers cites a drug analogy suggested by Edwin Artzt, then chief executive of Procter & Gamble to describe the allure and effect of forward buying.

Manufacturers begin loading because they are hungry for market share or hell-bent on hitting quarterly profit targets. The short-term high is this: You ship enough extra product to reach your financial goal, and maybe goose the stock.

Even as you feel good inside, financial health can deteriorate. Particularly in today’s slow growing markets, you find that to pump up the volume, or even maintain it, you must offer increasingly lucrative discounts and deals. During each load-in, you overwork your system: whipsaw production, crank distribution, stress your sales and marketing people. Costs rise. Inventories build. And build.

“Loading”, in this context, is the act of pushing more product down into your value chain than is necessary to satisfy existing, or even forecasted, demand. “Whipsawing production” and “cranking distribution” refer to attempting to produce and distribute at 100(+) % capacity for a period, only to drop down to minimal activity for a subsequent period. The impact of these practices on manufacturers, as well as their customers, is inevitably higher costs.

Buzzell, Quelch, and Salmon estimated that forward buying of “Nonperishable food-store products” added from \$930M to \$1.350B to distributors’ costs and from \$720M to \$1.584B to manufacturers’ costs. Their hypothesis that forward buying raises inventories 80% higher than otherwise necessary was confirmed by food distributors whom they interviewed.

The obviousness (Pache speaks of retailers/distributors actually building warehouses to store only forward buy inventories) and mutually destructive effects of both forward buying and diverting (the practice of buying product from the manufacturer at a low price and shipping them to where the price was higher) made them both targets of the efficient consumer response (ECR) reformation movement launched by a landmark paper from Kurt Salmon Associates. The truth is, however, that while information sharing and everyday low pricing has given rise to channel powerhouses like Wal-Mart, high-low pricing and forward buying is still prevalent.

In December of 1998, *Progressive Grocer* brought together executives from Nabisco, Procter & Gamble, Pepsi-Cola Co., and other well-known consumer packaged goods (CPG) companies as well as officers in the Food Marketing Institute, the Grocery Manufacturers of America, and Food Distributors International. This group was tasked with discussing the current status of the Efficient Consumer Response (ECR) movement in their industry. While many positive comments were offered regarding improved

technologies, information sharing, and category management, when asked where ECR has “fallen short”, Jack Haedick (Executive Vice President and C.O.O of One Source, Inc – a division of C&S Wholesale Grocers) stated:

There's still an awful lot of deal funding out there, which drives forward buying and diverting. These still tend to be a large part of income for anybody in the wholesale supply chain. When we started, we thought a lot of the deal funding would or should go away. That hasn't happened and it probably won't happen because there are a lot of second- and third-tier brands out there.

## ***2.1 THE PRISONERS' DILEMMA***

In the agriculture business, distinct growing/harvest cycles create a supply of corn that is as inescapably seasonal as the turning of the seasons themselves. These cycles expose both producers and purchasers to considerable price risk should there be an excess/shortage at the end of the cycle. To demonstrate with an allegory:

A corn farmer has had a bad season with the rain coming too heavily and too late. His fields have yielded half of their regular crop. Because all of his fellow farmers have experienced similar problems, the price of corn for the harvest is almost twice its regular price. This has a dire impact on the miller who buys the corn to produce meal because his costs have gone up and he may not be able to sell as much product if he raises his own prices.

The price risks associated with a spot market are, indeed, as old as the farmer and the miller. Both participants in this ancient value chain would gladly pay to reduce this risk. One way to do this is through buffer inventories. To continue with the allegory:

Three good seasons later, the miller has recovered from his losses during that one bad season. Deciding to prevent a reoccurrence, he builds a second silo and tells the corn farmer that he will need more corn so that he can ride out the next shortage. Delighted with the prospect of greater sales, the farmer hires extra hands, plows and plants larger fields and, at season's end fills both of the miller's silos.

The purchaser is now poised to “ride out” the next bad season. Of course this new ability did not come free. He had to pay for the construction of the silo, buy the extra corn and now must worry about the product spoiling over time, as well as the other risks like fire and theft. One small benefit is that he is also able to respond to unexpected increases in demand better than before.

The producer, however, has some very real problems. He now possesses more production capacity than is necessary to fill consumer demand (demand by the purchaser's customers). In addition to the additional cost that excess capacity brings, the producer must now worry that, in the event of a bad season, the purchaser may not need to buy much, if any, product.

The corn farmer, realizing that he had extra hands to pay and worried about not being able to raise his price should another bad season come along, realizes that he has no option but to raise his regular price. (Un)Fortunately, the miller has a buffer inventory, which allows him to purchase less, or not at all until the farmer is forced to reduce his price to pay his bills. This cycle of high and low prices continues for years.

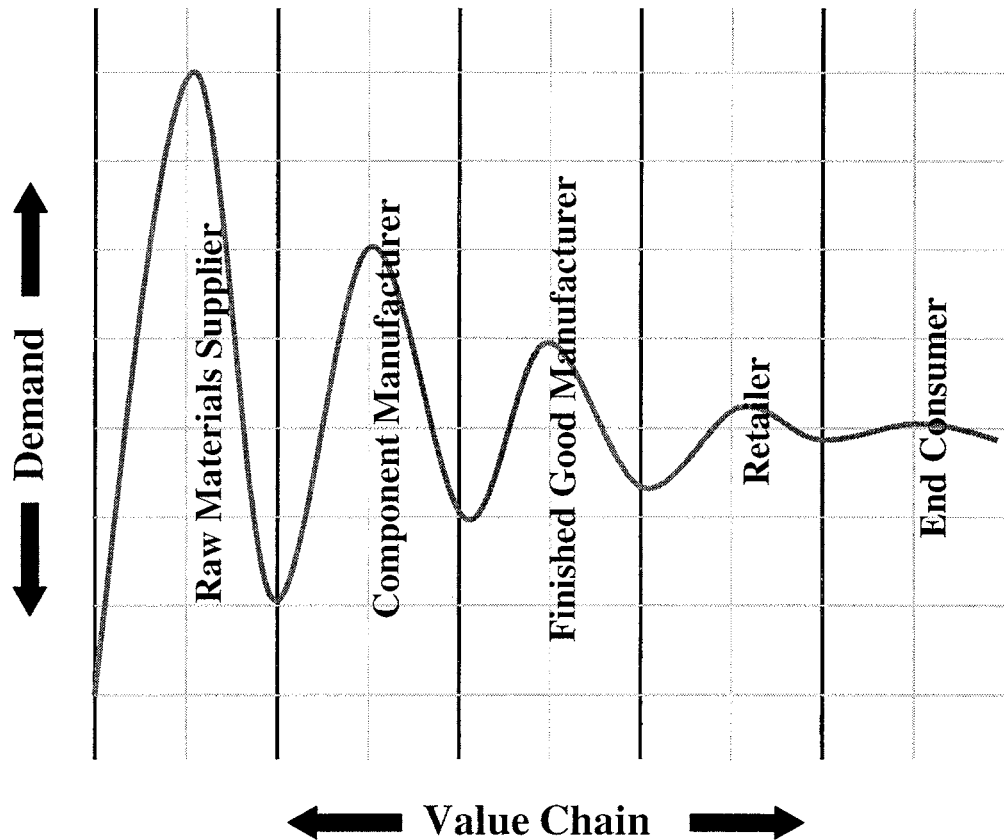
Relaxing one of the simplifying assumptions, it is possible to assume that there are multiple producers and multiple purchasers in the market. Assume, also, that each purchaser has built a buffer inventory and each producer has excess capacity as a result.

Recognizing a lose-lose proposition in the current situation, the corn farmer promises to charge the miller a single price, regardless of the harvest. This will remove the risk that caused the miller to store buffer inventory in the first place. A problem arises, however, when a bountiful harvest allows one of the farmer's neighbors to offer the miller a better price for that single season. Similarly, the farmer is tempted to sell at a lower price to the miller's competitors.

Ailawadi, Farris, and Shames make reference to forward buying as a prisoner's dilemma, a classic collaboration problem in which, for both parties to benefit, they must avoid temptation while trusting the other party to do so as well. Over the long run, collaboration would allow the cooperating parties to realize superior profits, however, most parties are unable or unwilling to look beyond the short run losses incurred by collaborating. As many ECR critics have pointed out, trust is the key ingredient here.

## 2.2 FORWARD BUYING AND THE BULLWHIP EFFECT

Exhibit 1 – The Bullwhip Effect



The familiar bullwhip schematic describes the increase in demand variability experienced as one distances oneself from end consumer along a value chain. While forward buying is a major cause of this effect, according to Hau, Padmanabhan, and Whang, it is only one of four. The other three major causes are demand forecast updating, order batching, and rationing/shortage gaming.

The demand forecasting component of the bullwhip is the result of two phenomena: safety stock being carried at all levels of the value chain and “rear-facing” forecasting algorithms. For example, if five units are sold at the retail level, where four were sold the week before, an order for seven (five for replenishment, one for the increasing trend and one for safety stock to cover demand uncertainty) is placed with the finished goods manufacturer, who will, in turn, add on his trend and safety stock when ordering from the component manufacturer.

Order batching is the process of placing orders in “economic quantities” or lot sizes meant to minimize logistics costs. Hau et al. also point out that order batching may be the result of infrequently run materials requirements planning (MRP) systems as well. This has the dual impacts of delaying the communication of changes in demand trends through

the value chain as well as lengthening the cycle time, requiring an organization to carry more safety stocks, amplifying the demand forecast component of the bullwhip stated above.

Forward buying is perhaps the most obvious culprit in the bullwhip effect. The accumulation of inventory during price “lows” and lack of buying at price “highs”, together with the safety stocks and regular demand/supply uncertainties cause manufacturing to move in leaps and bounds.

Rationing and shortage gaming are lesser components of the bullwhip effect that occur whenever the potential for a shortage of product is anticipated or perceived. Assuming that their orders will be reduced by some kind of allocation percentage, customers will raise orders (doubling or tripling them) in an attempt to secure sufficient product to completely satisfy their demand. These “excess orders” are then cancelled as the shortage abates, leaving excess capacity upstream in the value chain.

Of the four major causes of the bullwhip effect, all but one are the result of a lack of communication across the value chain. The amplifying effects of demand uncertainty and safety stocks could be alleviated if organizations could all see the forecast for end consumer demand and build to it. The uncertainty created by order batching, would also be reduced if demand planners across the chain could see the demand at their customers building up to the batch order size. Lastly, with a view of true consumer demand, organizations would not be fooled by shortage gaming on the part of their immediate customers.

Forward buying, alone, is the result of a conscious effort to “push” product into the next level of the value chain. Even with visibility of demand across the value chain, organizations would still be obligated to “crack the whip” in order to generate short-term revenue or to profit by arbitrage. As the model will show in chapter 3, forward buying is not a lack of information or a tactical error, it is a trap that is impossible to exit once an organization, or even one of its competitors, stumbles into it.

### ***2.3 THE FAILURE OF ECR TO ADDRESS FORWARD BUYING***

In 1995, Tim Hammond, the president of the Food Marketing Institute, offered an opinion on ECR and the original hope that every day low pricing (EDLP, also known as EDLPP – everyday low purchase price, and EDLC – everyday low cost) would help to rid the industry of forward buying by offering a fair price that was higher than the promotional price used to incent retailers to forward buy, but lower than the regular price offered between promotions.

There was a view at the outset of the ECR movement that every category of product would be affected by ECR. But I think there are some categories in which **forward buying** and diverting will continue to be important. Where manufacturers are still offering large discounts and differences from region to region, you'll see it continue. Only when manufacturers change will you see a change on the retail/wholesale side.

From a more academic and marketing focused view, Ailawadi, et al. appear to agree with this statement.

Because certain incentives and trade deals may perform important functions, managers must consider the second- and third-order effects of discontinuing them. Any careful analysis of pricing includes potential competitive reactions. The same logic applies to channels, so managers must assess how channel members are likely to react to various pricing strategies.

Both parties, then, would not be surprised by a report made in Progressive Grocer in 1993:

Respondents told Spar that **EDLP** brands have lost share, weaker items have been delisted and there have been more out-of-stocks at retail. At the same time, 46% predict that more brands will be switched to **EDLP** than last year, while 31 say the trend will be unchanged and 23% say fewer brands will switch.

Almost half of those surveyed say that when a major brand in a category goes to everyday low pricing, the primary competitive response is to promote more heavily. Twenty-seven percent say competitors also switch, 15% say competitors continue to promote at a lower percentage discount and 10% see no changes.

The article goes on to state that the brands which fared best in EDLP were those that held high market shares prior to going to EDLP (Procter & Gamble's Tide or Pampers being the obvious examples). Although, even P&G was eventually forced into a price war to maintain market share of Pampers in 1995.



The frustration on the part of manufacturers is probably best summed up by Thayer, commenting on disillusioning results from a survey of frozen food retailers in 1995:

We've gotten into making our profits from buying instead of selling, and nobody gives a damn about what the consumer thinks anymore... And where the rubber meets the road, we've got buyers who--less than half the time--see the consumer as the top priority when it comes to buying new products.

## ***2.4 SPOT MARKETS – THE BEGINNING***

According to Burns, a (spot) market is "...a mechanism for affecting purchases and sales of assets and services in a relatively public manner." Burns goes on to state that there are two transactions which enable a market: The dissemination of information regarding terms of sale and the exchange of assets. Burns further goes on to describe the three elements defining the efficiency of a market as liquidity, orderliness of market conditions, and the quality of the market's organization.

In March of 2000, a group of consumer packaged goods "heavyweights", such as Procter & Gamble, H.J. Heinz, and Philip Morris (owners of Kraft-General Foods), joined together with the Grocery Manufacturers of America to set up a "global industry-wide internet marketplace...to support catalog purchasing, bidding and price quotes, as well as online auctions for various services and supplies".

Retailers, too, are embracing business to business e-commerce. Two recent entries are GlobalNetXchange, a combination of Sears and French retailer Carrefour and Worldwide Retail Exchange, a collection of 11 U.S. and European retailers including Kmart, CVS, Royal Ahold, and Tesco.

While liquidity, orderly conditions, and the public dissemination of price information are not at true market levels yet, the FCPG industry is moving in that direction. It is not too much of an extrapolation to say that a consumer goods spot market is being born.

Historically, derivatives markets (commonly called commodities markets) have followed spot markets of the products in question, such as corn, oil, and corporate stocks. It is difficult, if not impossible, to name a spot market on which a derivatives market for futures, forwards, calls, or puts has not evolved for the purposes of "hedging" (offsetting) risks. It is arguable that fine art auctions meet Burns' criteria and yet there is no public market for art futures. However, Burns is careful to note that part of liquidity is a degree of homogeneity and standardized grades. While "homogeneity" and "standardized" cannot be applied to fine art, it does apply to a consumer goods manufacturer's product (section 1.2 for details) and sometimes, despite the best attempts of advertising, the entire product category across manufacturers.

With spot markets, such as the National Transportation Exchange and Logistics.com forming in national transportation, the increased connectivity of manufacturers/distributors/customers, and the “commoditization” of consumer products, a national FCPG product market exchange is a possibility.

## ***2.5 CONCLUSION***

Forward buying at the manufacturer/retailer level, is the direct result of manufacturers’ high-low pricing policies, designed to push inventory into the channel. The majority of the food and consumer packaged goods industry recognizes that the practice is detrimental to the entire value chain. ECR, through EDLP, has failed to eliminate forward buying, largely because manufacturers, distributors, and retailers are trapped by short-term profit focuses and a prisoner’s dilemma with regards to mutual trust.

A derivatives approach may be able to replicate the beneficial effects of forward buying while mitigating the damaging effects of inventory surges in the value chain. Spot markets, which are beginning to appear in the consumer goods industry, increase the feasibility of derivative markets in the food and consumer packaged goods sector.

### **3.0 MODELING THE PROBLEM**

Traditionally, static and localized cost/benefit models, like those in sections 3.1 and 3.2, have been used in decision analysis and decision rationalization. Unfortunately, these approaches fail to capture the impacts of decisions on the entire system. Even within an organization, it is possible that a single group, like a purchasing department, can optimize costs at the expense of sub-optimizing the entire organization through costs realized in other areas, such as warehousing. If this is possible inside an organization, the relatively greater complexity of client/vendor relations make it probable across a multi-organization value chain.

Static and localized decision models also fail to capture the effects of the decision on the system through time. Over time will the system simply change and retain equilibrium, will it oscillate prior to regaining equilibrium, or will the system build increasing momentum? These results depend on environmental conditions and feedback relationships which are, by definition, not found in a static model.

Due to these limitations, it would not be possible to evaluate the hypothesis posed in the introductory chapter, namely that forward buying is destructive to the entire consumer goods value chain, with a static model. Furthermore, such a model would be unable to anticipate the effect of a paradigm shift, such as the derivatives alternative suggested in the introduction, on the entire system. In contrast, a system dynamics model, as in section 3.3, should be able to replicate the existing symptoms as well as predicting the results of a shift in the dynamics of the system.

Ironically, the relationships between many of the variables in the dynamic model of the system are governed by static models, some as simple as profit being the difference between revenue and costs, and some as complicated as the balance of inventory carrying costs and purchase costs that incent a retailer to forward buy. For this reason, sections 3.1 & 3.2 contain static models suggesting the rationale for manufacturers' high-low pricing practices and retailers' forward buying habits.

### **3.1 THE PURCHASER'S FORWARD BUY DECISION MODEL**

In considering the appropriate “economic order quantity” for a purchaser faced with a “special discount” to make, Tersine suggests considering multiple parameters:

- the percent cost of holding inventory ( $C_h$ )
- the cost of ordering ( $C_o$ )
- the regular price ( $C_p$ )
- the “special price” ( $C_{pg}$ )
- the (end consumer) demand over the period ( $D$ )
- the regular order quantity ( $Q_w$ )
- the special price order quantity ( $Q_g$ )
- the optimal special price order quantity ( $Q_g^*$ )

Tersine asserts that the cost of forward buying in this case is made up of the cost of the product, the cost of the order, and the inventory carrying costs over the period of time that the excess inventory is drawn down. To further break down these costs:

The cost of product is the special price multiplied by the quantity purchased

$$\text{Product Cost} = C_{pg} * Q_g$$

The order cost is the administrative cost of placing an order coupled with any ordering fees levied by the manufacturer.

$$\text{Order Cost} = C_o$$

The cost of holding inventory is the percent cost of holding inventory multiplied by the product of the special price and quantity purchased (the product cost) multiplied again by the time period required for the inventory to be drawn down and divided by two to approximate average inventory level during that period. This seems deceptively simple until one considers that the percent cost of holding inventory must include obsolescence risk, the cost of capital or some other discount rate, insurance, and allocated warehouse overhead. Buzzell et al. identified a figure of 30% including handling, storage, and capital costs.

$$\text{Cost of Holding Inventory} = C_h * (C_{pg} * Q_g) * (Q_g/D) * 1/2$$

The total cost of the forward buying process, being the sum of the parts, is:

$$C_{pg} * Q_g + C_o + C_h * (C_{pg} * Q_g) * (Q_g/D) * 1/2$$

It is interesting to note that Tersine assumes a constant demand in the face of a discounted price. This unquestioned assumption that the purchaser should profit from buying well as opposed to selling the product through the channel, which is nowhere in evidence in these equations, is what Thayer mentioned: Distributors/Retailers are better at making money in buying than in selling.

Should the purchaser choose not to forward buy, perhaps out of philosophical objection or, more likely, because the warehouse is already packed with other forward bought merchandise, the loss associated with this choice is the sum of the incremental product

cost, incremental ordering cost, and decremental holding costs. Tersine's equation for the total cost, choosing to forgo the forward buy, is:

$$C_{pg} * Q_w + C_p * (Q_g - Q_w) + C_o * (Q_g / Q_w) + C_h * ((C_{pg} * Q_g) * (Q_g / D))^{1/2} + (C_p * Q_g) * ((Q_g - Q_w) / D)^{1/2}$$

By solving for the optimal order quantity, where optimality is maximum cost savings, Tersine derives the following equation:

$$Q_g^* = D * (C_p - C_{pg}) / (C_{pg} * C_h) + C_p Q_w / C_{pg}$$

...which leads to a projected savings of:

$$\text{Max Savings} = (C_o * C_{pg} / C_p) * (Q_g^* / Q_w - 1)^2$$

Using example data, Exhibit 2 depicts the relationship of quantity purchased and the sale price given regular unit price of \$2.00, periodic demand of 1000 items, holding costs of 20%, order costs of \$50, and a regular economic order quantity of 500 units. At 50% of the regular unit costs the equations suggests that inventory should be 500% in excess of need which, assuming constant demand, corresponds to 5 ordering periods of forward buying.

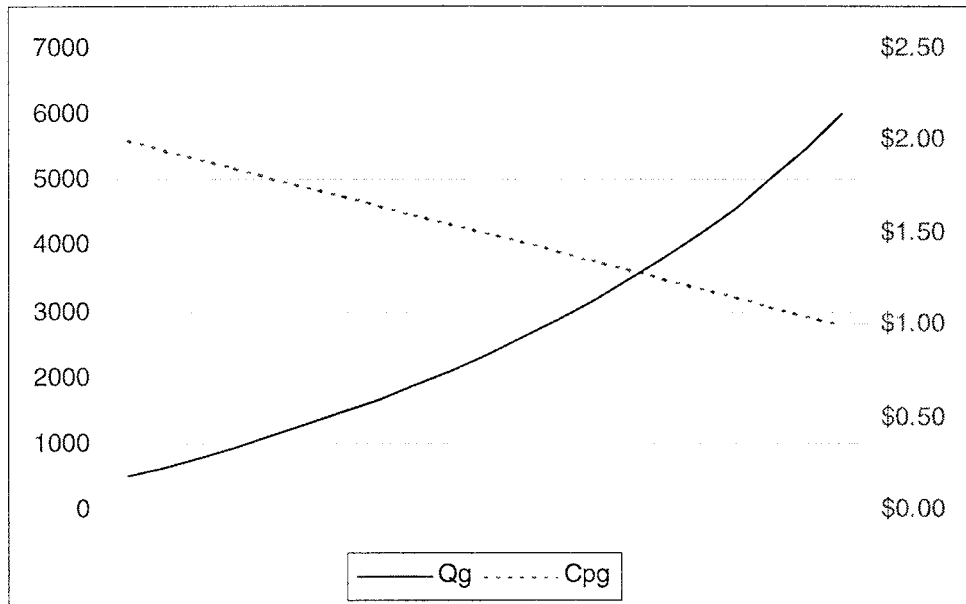


Exhibit 2 – Forward Buying Unit Cost Savings

Exhibit 3 shows the cost savings projected by the equations for the same example values used in Exhibit 2. By buying five extra periods of product, a retailer can realize over \$6,000 in cost savings. Gaining roughly one dollar of profit per unit on what would normally be a \$3.00 to \$4.00 item (50% to 100% retail markup) adds an extra 25% - 33% to a retailer's margins.

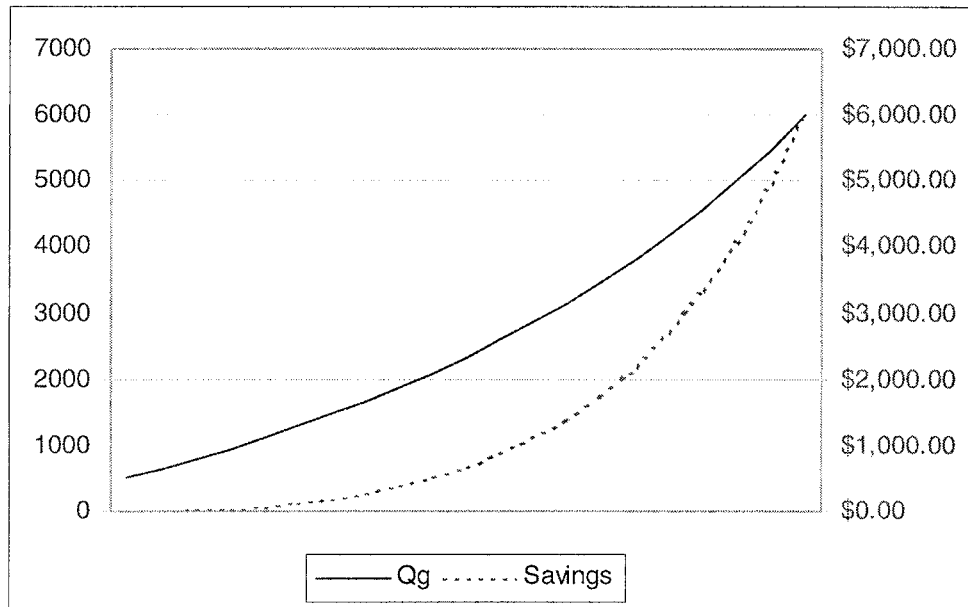


Exhibit 3 – Forward Buying Total Savings

It should be noted that Tersine's equations assume that the special price is a one-time deal which will not be repeated. In this, the amount of forward buying recommended by his model should be viewed as a maximum limit. Because trade promotions are frequently announced in advance, retailers often know the date, and potentially the deal, for the next promotion and will buy accordingly.

It is arguable that a portion of forward buy inventory achieves some practical value in serving as a safety stock. That value would likely be a function of the demand variability and the cost of loss sales. The cost of lost sales, however, is even harder to accurately calculate than the percent cost of holding inventory. The value of forward buy inventory as safety stock also depends on transportation lead times and the location of the inventory within a distributor's or retailer's network. A separate forward buy warehouse in Los Angeles will not reduce safety stocks held in east coast stores or distribution centers by much. Due to these uncertainties, the safety stock value of forward buy inventory will not be included in the model.

Another revenue generated by forward buying is returning the product at full price. The ability to buy product at a discount and then return it later for full price would seem unlikely, but the confusion surrounding reverse logistics has made it possible and profitable. This practice will also be excluded from the model. Similarly, the practice of requesting trade money from manufacturers to help draw down high inventories of

existing product (that were bought on discount) in order to make way for new product will not be included either. Lastly, the practice of buying excess product on trade promotion and then shipping to an area outside of the promotion, known as “diverting”, will not be included in the model as it is arbitrage across space and the focus of this paper is on arbitrage across time.

### ***3.2 THE PRODUCER’S HIGH-LOW PRICING DECISION MODEL***

The cost/benefit of forward buying, or more correctly, of incenting forward buying through high-low pricing, on the manufacturer is more difficult to quantify. Buzzell et al. suggest that it is a function of the interval between promotions and the number of stock keeping units (SKUs) being promoted. While this is probably true, it does not describe well the total cost to manufacturers.

The most obvious cost associated with selling at a discount is the loss of revenue due to the lower price. Even in this instance, identifying the cost or profit requires something as complex as a price elasticity curve to understand what amounts could have been sold at what price.

The major cost which Buzzell et al. and others have pointed to, concerning the manufacturer, are the costs of “pre-building” inventory in anticipation of a sales blitz or the costs of excess capacity during the periods of low demand leading up to the blitz. In the former instance, we can apply Tersine’s carrying costs, however, in the later case it is necessary to examine the costs of production capacity (unless excess demand is outsourced to another producer). Assuming that the manufacturer’s costs are competitive, it may be possible to judge the cost of excess capacity as the quoted cost by a contract manufacturer (outsourcer).

Excess capacity costs are also tricky because most production lines are able to run multiple products. Theoretically it is possible for a manufacturer to balance trade promotions on products such that the production volume for the sum of all products is consistent. The absence of any mention of this tactic in the literature review indicates that this is not the case. Perhaps this is a function of the large amount of coordination that this balance would require between marketing and production people, technologies, and processes within the organization.

The costs of distributing products sold in high-low cycles is very similar to the manufacturing costs. Pick/Pack and transportation operations require asset investments to achieve an excess capacity level. While outsourcing fleet operations (like today’s 3<sup>rd</sup> or 4<sup>th</sup> Party Logistics services) or taking advantage of newly forming transportation exchanges (National Transportation Exchange, Logistics.com) can reduce these costs by removing the need for excess trucks and drivers between promotions, there is still an expense in creating a warehouse which is able to pick/pack/ship multiple periods worth of product in one period.

The sole benefits of high-low pricing appear to be strategic marketing and control over revenue flow. Without an overpowering brand, such as Procter & Gamble or Intel, or differentiating customer service, such as Dell, it is difficult or impossible to compete in an industry characterized by high-low pricing with an everyday low price strategy. Retailers, whose strategies include forward buying as a critical component, become displeased and begin to de-list lower volume products (Progressive Grocer, 1993, cited in 2.3).

Control over revenue can be a critical strategic tool for executives interested in, among other things, meeting analysts' expectations in order to keep up the stock price. This is a short-term strategy, though, as opposed to a long-term strategy. High-low pricing allows a manufacturing executive to control the demand and revenue flow from immediate customers, however most of the literature reviewed indicated that it had little effect on the ultimate consumer demand. To sum it up then, manufacturing executives, as a whole, are buying control over the timing of revenue flows at the expense of production asset and/or inventory costs. Overriding the costs and the benefits is the strategic need to battle other high-low pricing manufacturers for market share.



### ***3.3 OPTIONS PRICING***

An option is the opportunity, but not the obligation, to perform an action. As an example, an option in the financial markets normally refers to the right to buy or sell a particular asset at a given price at or before a given expiration date. The asset is normally a stock or some type of commodity, such as bushels of corn or barrels of petroleum. Because the value of these options is derived from the value of the underlying asset (the opportunity to buy a barrel of petroleum at a given price would be more valuable if the price of petroleum on the open market is much higher than that given price), options are also known as derivatives.

The two most basic types of options on derivatives markets are known as calls and puts. A call option is a contract that gives the owner a right to buy a specified quantity of a specific item (the underlying asset) at a specific price (the strike price) at or before a given date (the expiration date). To gain this right, the owner probably purchased it at whatever the market rate was for such an option at that time. A put option is very similar to a call option with the difference being that a put is the right to sell, as opposed to being the right to buy.

The person who sold the option is obligated to sell (in the case of a call option) the specified quantity of the specific item at the agreed upon price to the current owner of the option if that owner chooses to exercise his option and buy the item. Conversely, the person who sold a put option is obligated to buy from the owner of the option if that owner choose to exercise his option. In this way, an option is optional for the buyer and obligatory to the seller.

The owner of a call option makes money if the price of the underlying asset rises above the strike price by the amount that he paid for the option. As an example, if the owner paid \$5 for the option of buying a barrel of oil at a price of \$20 per barrel and the market price of oil goes up to \$30 per barrel, then the owner can exercise his option, buy the oil at \$20, sell it at \$30, and make \$5 profit after subtracting out the \$5 cost of the option.

While many speculators buy and sell options hoping to make money, others use these markets to reduce the risk of their businesses. For example, a wheat farmer can buy a put option which allows him to sell his crop at a specified price, regardless of the price of wheat at the end of the harvest. In this way the farmer is protected if the price of wheat drops between now and the harvest. If the price of wheat is higher than the strike price, though, the farmer can throw away the option, since it is not an obligation, and sell his crop for a higher price. In this way, options are a form of “price insurance”.

Options can be price insurance for buyers too. If a food manufacturer buys a call option on wheat, he has put a maximum price limit on what he will have to pay, regardless of the cost of wheat on the spot market. When the manufacturer is ready to buy the wheat, he simply informs the seller of the option who is obligated buy the wheat on the spot market for the going price and deliver it to the manufacturer for the strike price. Often, the two parties agree that the seller will simply pay the difference between the spot market price

and the strike price to the option owner and the owner will take care of buying from the spot market. This enables speculators, who normally lack the contacts to buy and ship large commodities, to participate in these markets, making the markets more fluid for the true “hedgers”, or people who participate to reduce risk.

A critical question for both buyers and sellers, speculators and hedgers, in a derivatives market, though, is: What is the option worth? How is a participant to know if the option is overpriced or underpriced?

In 1997, the Black-Scholes pricing formula for a call option won the Nobel Prize in Economics. Reference The concept behind the formula is, simply put, to replicate the benefits of a call option, through buying/selling both the underlying asset and bonds. By buying an amount of the underlying asset, such as a barrel of petroleum, and taking out a loan (selling a bond short) for a specific sum, Black and Scholes were able to define a perfect substitute for a call option, which immediately defines the market price.

The Black-Scholes formula is complicated, due to the probabilistic nature of future prices. This is the result of setting the assumption that all information known about the underlying asset is publicly available, implying that any future movement of the price is unknowable and hence, random. Put another way, if anyone knew that the future price of an asset, such as corn, would go up, they would start buying corn, driving up the price, until it reached the new higher price. So, assuming an efficient market, future prices are unknowable and probabilistically random.

This is not the case with food and consumer packaged goods products. As illustrated in Tersine’s formulae, the regular price of the product is known or at least it is known within a reasonable price range. This implies that the value of an option is the difference between the strike price and the expected market price up to the expiration date. To be more precise, the option is worth a bit less than the difference of the prices, due to interest rates and the time value of money.

It is possible, then, for a manufacturer to generate revenue by selling call options for less than the difference between the strike price and the expected market price. By buying these call options, retailers are able to increase profit by reducing purchasing costs.

### **3.4 SYSTEM DYNAMICS MODELING OVERVIEW**

According to John Sterman, the Standish Professor of Management and Director of the System Dynamics Group at MIT's Sloan School of Management, system dynamics is

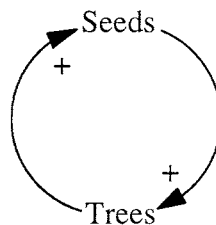
“...a powerful method to gain useful insights into situations of dynamic complexity and policy resistance.” Cite

Sterman cites Meadows as defining policy resistance as

“...the tendency for interventions to be delayed, diluted, or defeated by the response of the system to the intervention itself.” Cite

The power of system dynamics comes from examining the results of actions in the context of a system, as opposed to a simple cause and effect relationship. This allows a model to suggest not only the initial effects of an action on a target, but also the downstream “ripple” effects on entities or processes linked to the target. In the event that these downstream entities/processes are linked back to the original target, forming a cycle, system dynamics models describe the amplifying or balancing effects of this linkage.

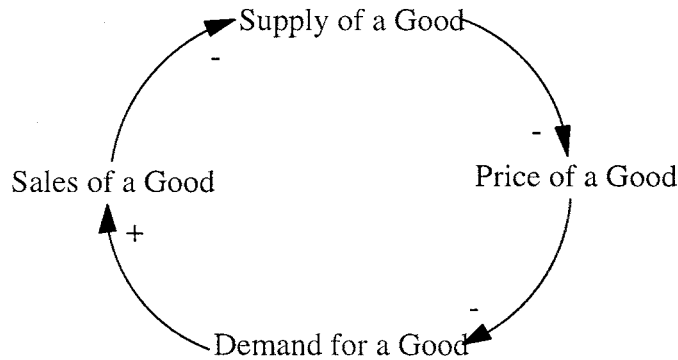
In his simplest of examples, Sterman points out a system dynamics model suggested by his then seven year old son:



*Exhibit 4 – Seed/Tree System Dynamics Cycle*

The model states that an increase in the number of seeds leads to an increase in the number of trees, which leads to a greater increase in the number of seeds. This type of amplifying, or “reinforcing”, feedback system is familiar to anyone who has brought a microphone too close to a loud speaker. This electronic/mechanical feedback is precisely what led Jay Forrester, the founding father of systems dynamics, to begin looking into the phenomenon. Reinforcing loops like this result in exponential, not linear, growth. One tree generating two seeds will create two more trees. Then together, the three trees create six more seeds, etc.

System dynamics also accounts for balancing loops in which two or more contending forces hold a system in equilibrium. The law of supply and demand is a good example of such a relationship.

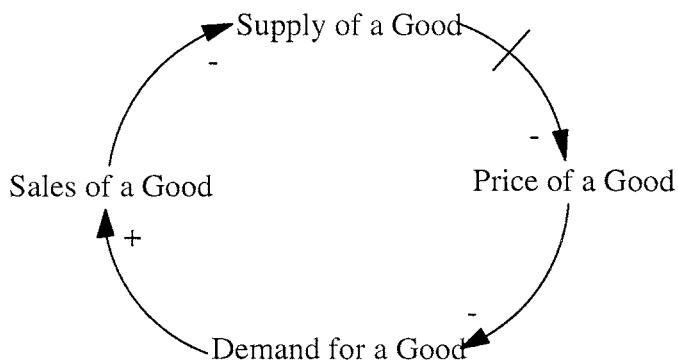


*Exhibit 5 – Supply & Demand System Dynamics Cycle*

As the supply of a good goes up, the price of the good goes down, which brings the demand of the good up, driving greater sales of the good, which reduces the supply of the good. As a notational note, the negative notation implies a negative correlation between the movement of first entity and the movement of the second entity. For example, price moving down causes demand to go up. If price were going up, demand would go down.

This cycle continuously seeks equilibrium regardless of whether supply begins by moving up or moving down (i.e. Supply going up above equilibrium will eventually bring supply back down and supply going down below equilibrium will eventually bring supply back up). The cycle, or “loop”, also works regardless of where analysis is begun. Had the cycle begun with demand going down, sales would go down too (positive correlation) which would increase supply, diving down price, leading to an increase in sales.

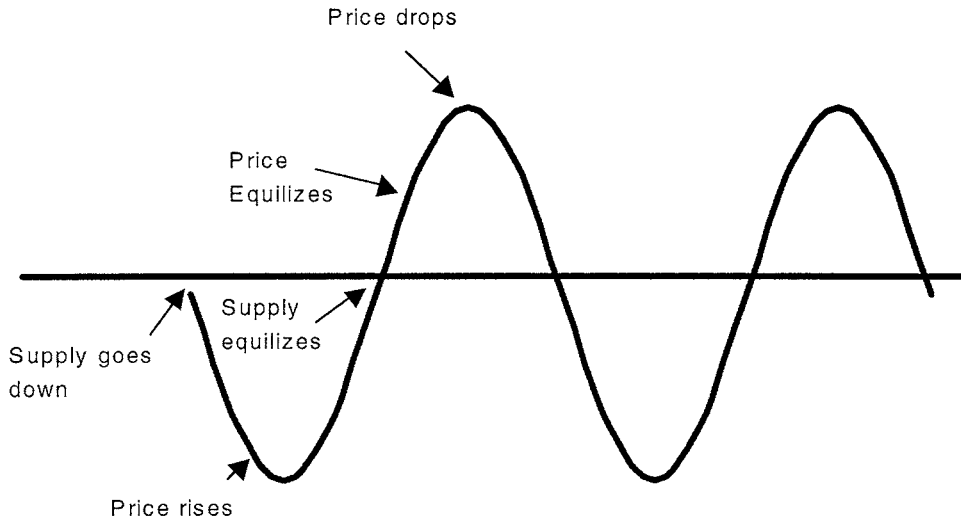
In this form, this model assumes that the execution of the cycle happens instantaneously. Supply, therefore, always remains constant because sales react the instant that supply is raised or lowered. Including a delay into the model, between the reaction of price to supply for instance (Exhibit 6) causes a new phenomenon.



*Exhibit 6 – Supply & Demand System Dynamics Cycle with Delay*

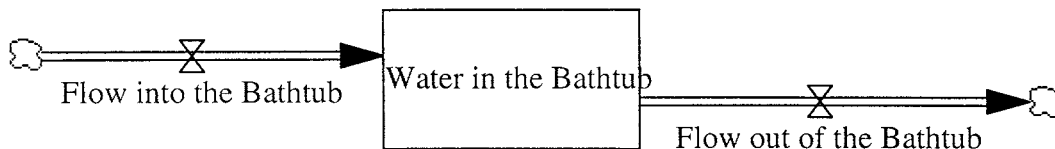
If supply rises, but there is a delay before price is adjusted down, then supply will continue to rise until demand grows and increased sales bring supply back to equilibrium. Supply will not stop at equilibrium, though, because the feedback delay will continue to

drive it down until price is adjusted again. In this manner, supply will oscillate around a constant amount in a sinusoidal manner as shown below.



*Exhibit 7 – Oscillation in a System Dynamics Model*

In order to model continuous systems, like inventory flowing through a warehouse, system dynamics uses a stock and flow methodology which is explained by Sterman using a bathtub model. The flow of water into the bathtub causes water to accumulate in the tub if the flow of water down the drain is slower than the flow of water into the tub. Put mathematically, the difference between the rate of flow into the bathtub and the rate of flow out of the bathtub is the rate at which water in the tub is accumulated. From a calculus perspective, the difference between the flows is the first derivative of the amount of water in the bathtub.



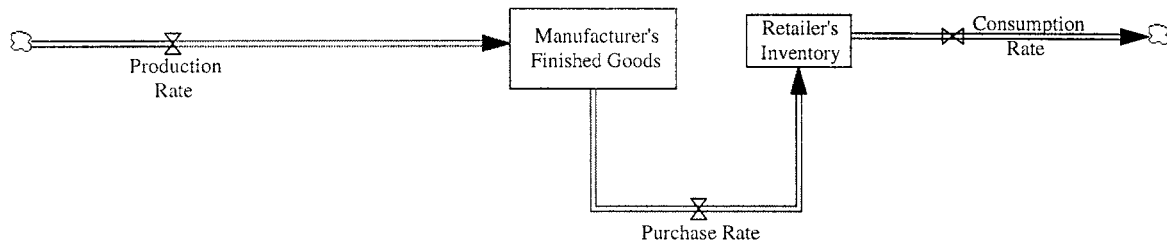
*Exhibit 8 – System Dynamics Stocks and Flows, Bathtub Diagram*

In the simple bathtub system detailed in Exhibit 8, the water is assumed to come from some infinite source (the cloud on the left) and is assumed to go to some infinite sink (the cloud on the right). In a more complicated example, the water could be sourced from a water heater which is, itself, sourced from a well. If one were to construct a complete water cycle, including ocean, clouds, and rain, it would be possible to show the effects of increasing or decreasing the flow of water into the tub on the entire system, including the feedback effect as the water cycles through sea, sky, and rain, back into the tub.

While the effects of a single bathtub's flows may have a negligible effect on the Earth's water cycle, a leading customer's purchasing habits are likely to have a much larger effect on a manufacturer's inventory, production, and marketing policies. Similarly, while the average Earthly rainfall is unlikely to affect the flow of water in a bathtub, the marketing practices of a manufacturer will most likely affect a customer's purchasing policies. Section 3.4 advances a model which attempts to describe some of the more pertinent stocks, flows, loops, and feedback for high-low pricing and forward buying across the FCPG supply chain.

### **3.5 A QUALITATIVE SYSTEM DYNAMICS MODEL**

The model describing the high-low pricing/forward buying phenomenon can be explained as a cycle of decisions based on initial inputs and subsequent results. The flow of inventory through the channel is limited to the manufacturer's finished goods, which are built up by a production rate, a purchase rate which draws down the manufacturer's finished goods and increases the retailer's inventory, and a consumption rate which draws down the retailer's inventory (Exhibit 9).



*Exhibit 9 – System Dynamics Inventory Stocks and Flows*

The *Sales Volume* loop (Exhibit 10) models how *purchase rate* affects the *manufacturer's revenue* and the *manufacturer's market share*. As the *purchase rate* falls, the *revenue* and *market share* fall also (the positive notation at the end of the arrow denoting a positive correlation). The rise of these two variables reduces the *manufacturer's credibility*, resulting in lower stock prices and a worse reputation. This credibility is qualitative. It is the aggregation of multiple measures, such as quarterly profits versus target, annual growth, etc. The measure is important as it is how executives are judged or, in effect, what holds off their own involuntary retirement.

With the *manufacturer's credibility* down, the *incentive to sell* rises (the negative notation denoting an inverse relationship), driving the manufacturer to offer a *trade promotion*. The *trade promotion* will reduce the *purchase price* of the manufacturer's product. As intended, a reduced *purchase price* brings down a *retailer's cost*, raising the *incentive to buy*, driving up the *purchase rate*.

We can see that this cycle balances itself in that beginning with a lower purchase rate caused the system to raise the purchase rate. Because reactions are not immediate (the cross on the mkt share & profit to credibility arrows means delay), this system oscillates up and down (sinusoidally), leading to the high-low purchase price and excesses/shortages in inventory and production capacity described in the literature.

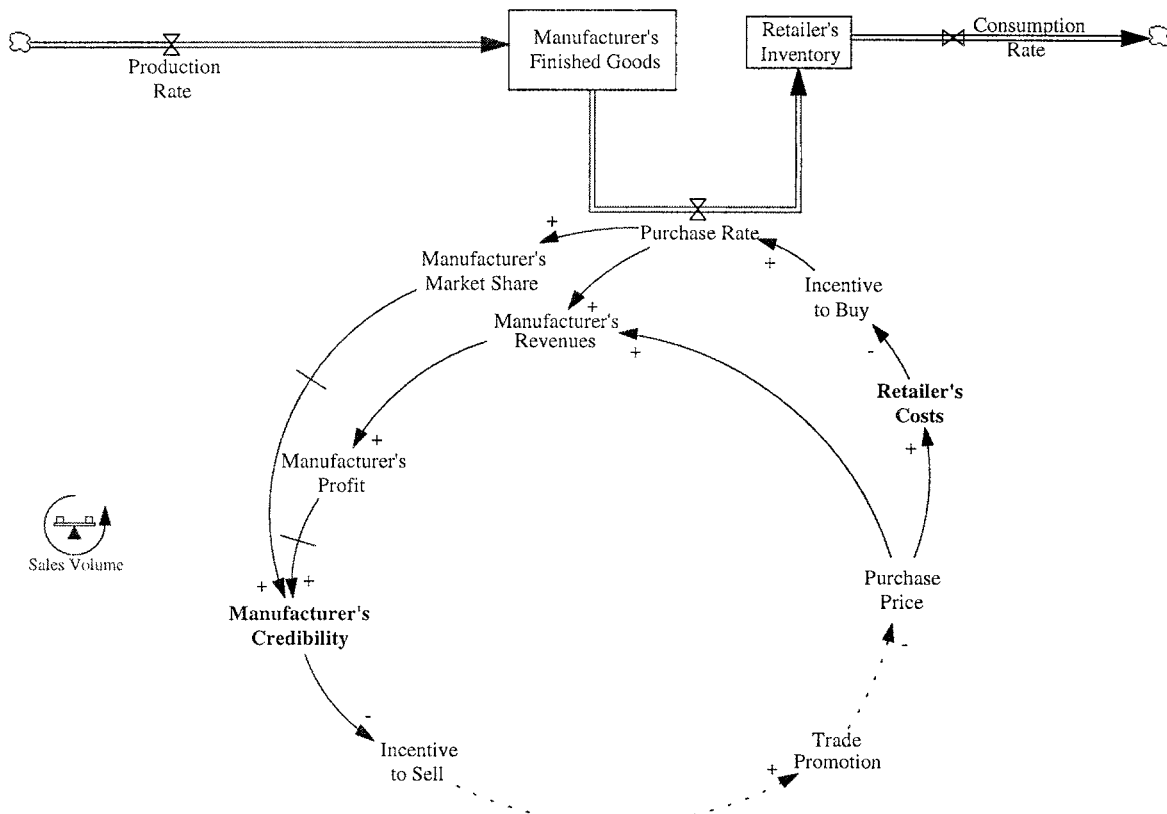


Exhibit 10 – System Dynamics Sales Volume Cycle



The second loop, *Excess Capacity Costs*, (Exhibit 11) integrates the manufacturer's revenue stream into the model. Here, *purchase rate* depletes the amount of the *manufacturer's finished goods* like the drain valve on a bathtub. The greater the purchase rate, the faster the finished goods are depleted. Because the purchase rate is oscillating between high and low, the manufacturer must either vary the production rate from high to low or hold the production rate steady and carry a buffer of inventory. Varying the production rate implies paying more for the *manufacturer's capacity* while holding inventory will increase the *manufacturer's carrying costs*. Both of these factors will drive up the *manufacturer's costs*, having a negative effect on the *manufacturer's profit*.

This loop is more dangerous than the previous loop in that, instead of returning to a balance, it snowballs. Higher *manufacturer's costs* lead to more *trade promotions* leading to more of the *manufacturer's costs* associated with trade promotions.

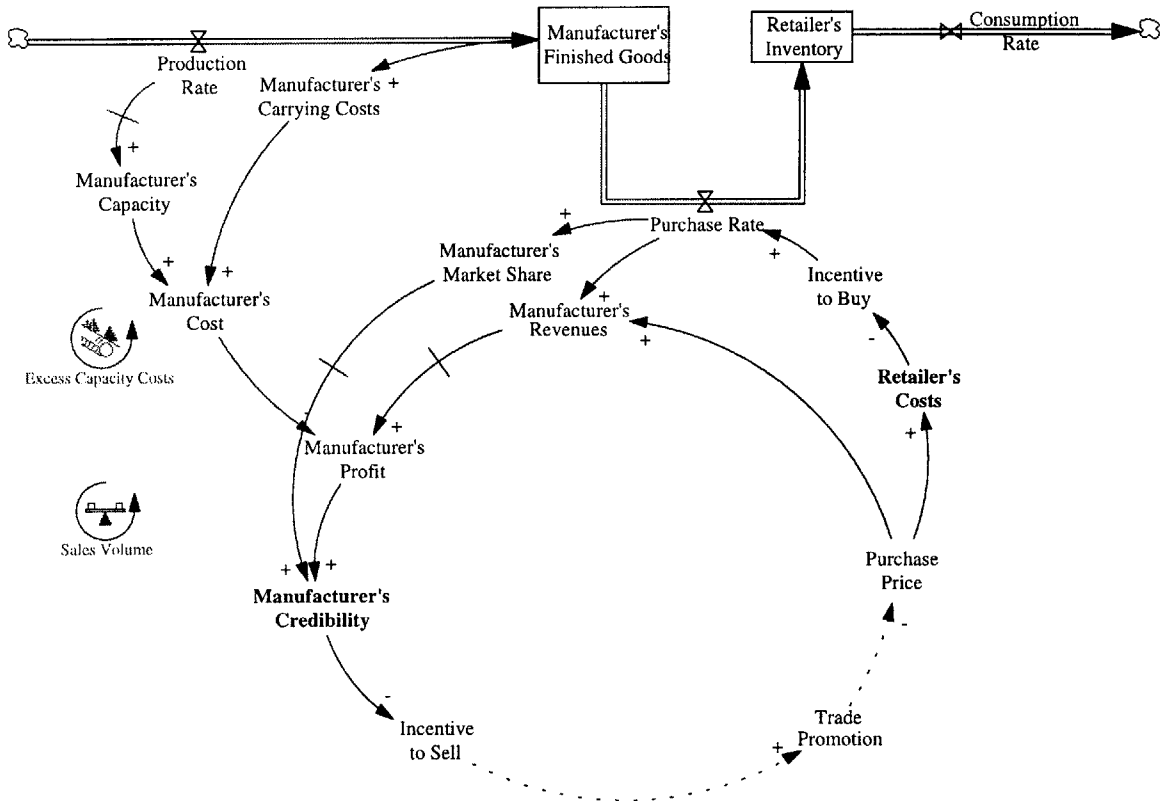


Exhibit 11 – System Dynamics Excess Capacity Cost Cycle

Loop 3, *Market Share* (Exhibit 12), adds complexity by including some rudimentary game theory into the model. As the manufacturer engages in trade promotion to build the *manufacturer's market share*, the *competitor's market share* falls. This assumes a “zero sum game”, meaning that trade promotion activity does not ultimately increase the size of the market, which is consistent with claims in the literature.

As the *competitor's market share* falls, the competitor will engage in trade promotion, in effect lowering the *competitor's purchase price*, which will recapture market share, forcing back down the *manufacturer's market share*. This is another balancing loop in that the manufacturer's market share will resist being moved in either direction, up or down.

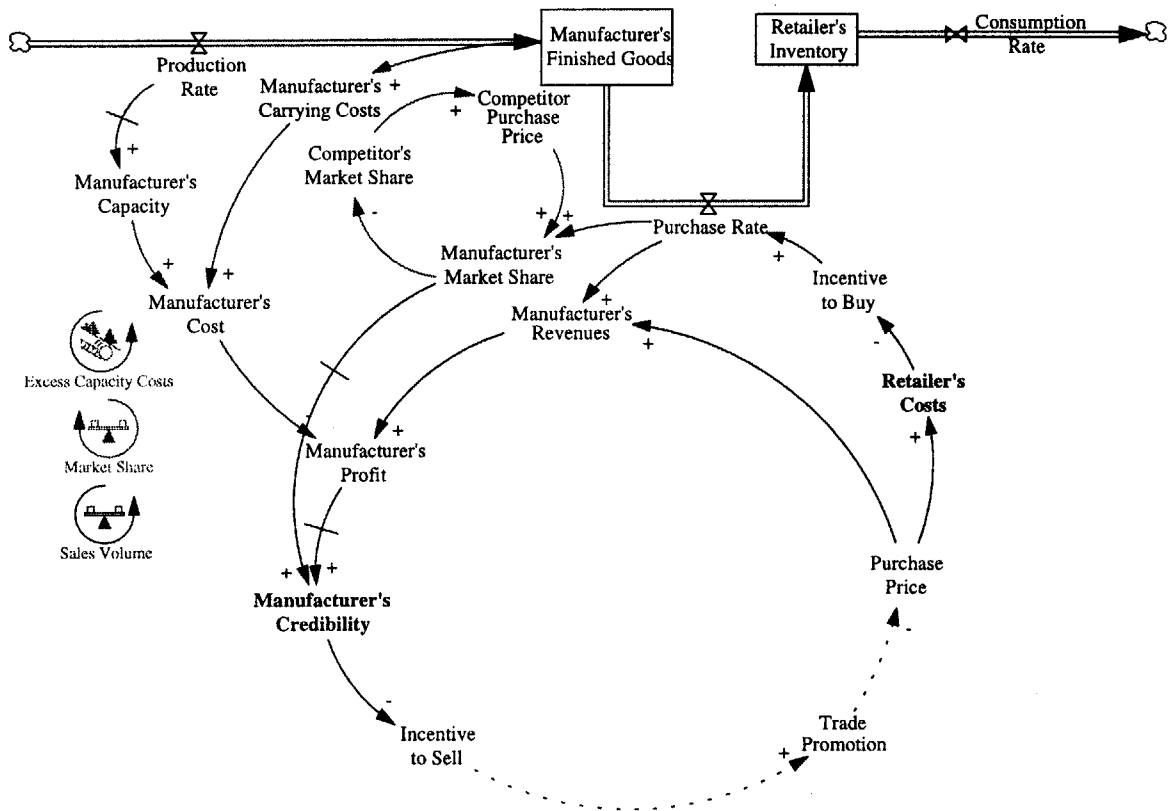


Exhibit 12 – System Dynamics Market Share Cycle



***Derivative Revenue*** is the fifth and final loop (Exhibit 14). It introduces a derivatives solution into the model. As the *incentive to sell* rises, the manufacturer refrains from *trade promotions* in favor of offering a deal on future purchases by the retailer. The manufacturer offers to sell to the retailer a call option, entitling the retailer to purchase a certain amount of product for a specified price (the strike price) before a given day (expiration date) for an upfront fee (the option price). The retailer is enticed into making this purchase by the manufacturer either reducing the *price of call option* below what it should be worth (e.g. \$1 for a \$2 discount expiring next month on 100 pallets of an item) or by the manufacturer reducing the *strike price* (e.g. \$2 for a \$3 discount next month on 100 pallets of an item).

The *number of calls sold to retailer* will depend on how “sweet” the deal is, or how low the *price of call option* and *strike price* are. The *number of calls sold to retailer* and the *price of call option* will dictate the *derivatives revenue* which will directly impact the *manufacturer’s profit*. Put another way, the manufacturer just sold a certain amount of product at a certain price. Since that product is an “option” and takes up no space, it is delivered over the internet instead of by truck and it takes up hard drive space instead of warehouse space.

To continue on the loop from the strike price, where it split, the lower *strike price* will reduce the *retailer’s costs* as if it was a *trade promotion*. The big difference is, while the retailer bought the options that day (derivatives revenue increases retailer costs), the dealer doesn’t need to purchase the inventory all at once in order to reduce costs. The deal price that the retailer bought is good over a period of time. The lower *strike price*, then, reduces the *retailer’s costs* over a period of time (thus the delay symbol). This prevents the purchase rate from oscillating, allowing a reduction in *retailer’s carrying costs*, *manufacturer’s carrying costs*, and *manufacturer’s capacity* without eliminating the retailer’s ability to “buy on deal” or the manufacturer’s ability to promote against a competitor or “borrow revenue forward” to meet a fiscal target.

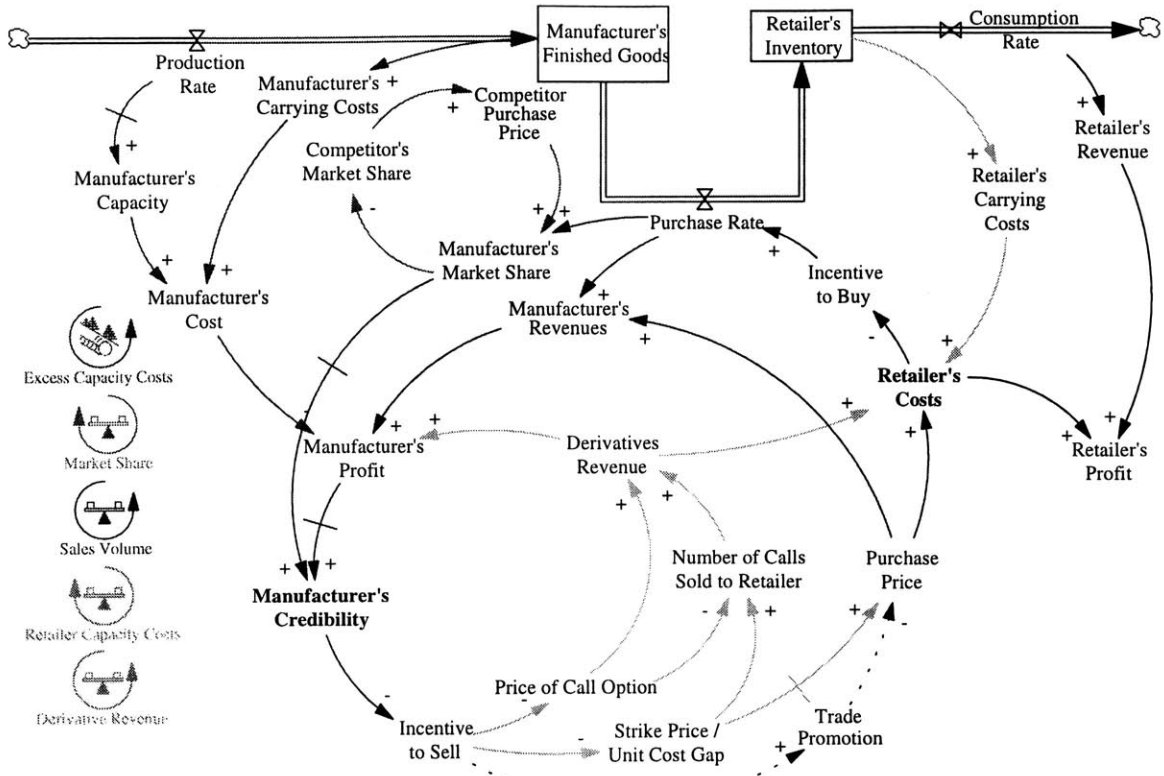


Exhibit 14 – System Dynamics Derivatives Revenue Cycle

### ***3.6 CONCLUSION***

As chapters one and two discussed, high-low pricing/forward buying is as much a strategic decision as a quantitative decision. While the costs and benefit to the retailer can be stated mathematically, the costs to the manufacturer are difficult to discern and the benefits to the manufacturer are mostly, if not fully strategic in nature. A qualitative study of the dynamics of the system yields a model that can be tested for its ability to exhibit outcomes similar to those observed in the consumer goods industry. After proving itself by replicating the existing environment, this model can then be used to qualitatively assess the effects of a derivative mechanics approach on the manufacturer's and retailer's costs as well as the manufacturer's strategic position in the marketplace.

## **4.0 ANALYSIS**

Three answers are required of the model in order to validate the proposed solution of using derivatives as a preferred alternative to high-low pricing. The predictive capability must be established by proving that the model is able to replicate dynamics found in the current environment. The model must then prove that derivatives offer better benefits and lower costs than high-low pricing. Finally, the model must prove that it is possible to progress from the current state to the future state.

### ***4.1 REPLICATING THE CURRENT ENVIRONMENT***

In the current state of the consumer packaged goods industry, manufacturers continue to offer high-low pricing, although it appears to increase costs, and retailers continue to forward buy and discourage manufacturers from switching to everyday low pricing. The model should be able to replicate these decisions.

As a starting point, assume that at some point the manufacturer's credibility has fallen, causing the manufacturer to increase trade promotion activity, lowering purchase price and incenting retailers to buy more, which increases the purchase rate. The manufacturer has successfully captured market share and grown sales revenue, or at least sales volume. Inventory has been cleared out of the warehouses, causing carrying costs to drop down which, would tend to bring profit up, depending on how much of a loss the product was sold at to get it out of the door. Assuming that profit did go up, the manufacturer's credibility is restored and trade promotions are reduced. Over the short term, the manufacturer has done well. Profit is up, Revenue is growing, and market share is high.

The backlash from this strategy begins in two places. The retailer, who has lost incentive to buy as the purchase price rises, sells the product at the normal rate for the normal price, enjoying a higher margin through forward buying savings. Also, the competition, concerned over losing market share, respond with trade promotions of their own.

The manufacturer now realizes that market share is falling because the competition has initiated trade promotions. Profit is falling because factories continue to produce and inventory is building up in warehouses. All of this causes the manufacturer's credibility to fall, forcing another trade promotion in order to maintain position. This cycle will continue over time with both the manufacturer and the retailer building excess production/storage capacity to accommodate this artificial business cycle.

In the event that the manufacturer institutes an everyday low price (i.e. stops trade promotion practices) in an effort to escape this cycle, the combination of excess production/storage capacity and slow sales while the channel "de-loads" (the retailer sells the inventory from prior trade promotions) drops the manufacturer's credibility. This happened in 1999 at Campbell Soup Co. and resulted in the CEO, Dale Morrison, being replaced by his predecessor, a man known for use of trades promotions.

One more thing that the model shows is that whether a manufacturer or its competition is the first to launch a trade promotion, everyone who produces similar products is drawn into this pricing battle. The exceptions to this rule are companies whose branding is strong enough to prevent erosion of market share in the face of price discounting, such as Procter & Gamble, and companies with a product that is differentiated enough to command a price premium in regular markets, such as Cannondale. This helps to establish a limit for the model. The model is effective for companies whose market shares are normally swayed by pricing, whether the pricing is their own or competitors. Put another way, the high-low pricing/forward buying cycle is a trap only for companies whose products are sufficiently similar so as to act like commodities.

#### ***4.2 ANALYSIS OF A DERIVATIVES SOLUTION***

Beginning, as in section 4.1, with a manufacturer facing reduced credibility (perhaps because a competitor has launched a trade promotion, the model can be used to show that a derivatives solution can reinforce credibility without increased capacity or storage costs to the retailer or to the manufacturer.

As the manufacturer's credibility falls, a call option is offered to retail customers. The option is priced such that the retailer can pay now (increasing profits) for the option of buying over a later period at a lower price. The price of the option immediately boosts profit and the manufacturer has virtually insured that the retailer will be buying a constant amount of product throughout the following season. The retailer has secured a better purchase price, keeping costs as low as forward buying, if not lower given that the retailer can shed the excess storage capacity required by forward buying. The manufacturer, similarly, has defended market share and temporarily boosted profit without creating an inventory bullwhip with all of its associated inventory carrying costs and excess production capacity.

Over time, the manufacturer will be able to offer a lower price than the trade promoting competition because supply chain costs associated with trade promotions have been reduced. At this point, market share is not only maintained, but it begins to rise, driven by the higher purchase rates, which were fueled by lower prices. Alternatively, a manufacturer could choose to keep prices even with competitors, taking the cost reductions a profit. All of the potential uses of costs which are lower than the competition, such as broadening the product portfolio, increased consumer promotions, and strategic acquisitions, are not accounted for by the model, but like profit and market share, they all lead to improved credibility, which is synonymous with shareholder value.

Because this iteration of the model began with manufacturing credibility low, it shows that a derivatives solution can not only be used to avoid falling into the costly trade promotion cycle, but rather it can be used by companies currently engaged in the trade promotion cycle. The expiration dates and quantities on the options can be tailored to slowly "de-load" the channel over time, which gives operations departments time to plan for reduction or retooling of soon-to-be excess capacity.



### ***4.3 LIMITATIONS OF THE MODEL***

Section 4.2 notes one limitation of the model, in that it does not reflect the myriad of strategic and operational uses of reduced costs. This section will cite other limitations of the model with the intention of suggesting future research opportunities.

One of the primary limitations of the model is that it remains qualitative. While system dynamics accommodates data and formulaic relationships well, the gathering of data, which includes rather nebulous items such as price-elasticity curves and inventory holding costs, remains to be accomplished. Given such quantitative information, the model could be tuned to replicate trade promotion sales cycles in the current environment and may be able to suggest the potential savings of a derivatives solution to the food and consumer packaged goods industry.

Another limitation of the model is that it fails to account for the trading of such options across customers and potentially back to the manufacturer. If the manufacturer projects insufficient capacity, it could offer to buy back the options to reduce the load. It is even possible that speculators could buy/sell options, gambling on unforeseen changes in demand or capacity. The mechanics of a derivatives market, which are likely to impact the viability of this solution, are beyond this model.

The model fails to account for other solutions to the forward buying phenomenon, such as the sell-through promotions recommended by Ailawadi et al. It is possible that the power in the channel could shift back to manufacturers, allowing them to curb the expensive practice of trade promotions in favor of end consumer promotions. The rise of customer direct marketing through the internet is one way in which manufacturers may begin to gain power over retailers.

Finally, the model does not consider the ramifications of government regulation from either a pricing standpoint or an anti-trust standpoint if an industry-wide derivatives solution is accepted. Traditional commodities trading has been heavily regulated by government agencies.

Overall, however, while the model is limited, it is able to demonstrate the potential of the derivative solution to reduce costs across the supply chain without risking lost credibility for manufacturers. The mechanics, quantitative analysis, and regulation of this potential, though, remain to be considered.

## **5.0 SUMMARY AND CONCLUSION**

For the large number of food and consumer packaged goods products that are time sensitive, value to the end consumer is lost over time. Because the end consumer is the ultimate source of income for the entire supply chain, creating better value for the end consumer should be in the best interests of every member of the supply chain. The practice of high-low pricing/forward buying, a means by which retailers and distributors profit from manufacturers and manufacturers vie for short-term untenable strategic gains, delays the flow of product in the supply chain, reducing value to the end consumer.

### ***5.1 THE CYCLE OF HIGH-LOW PRICING AND FORWARD BUYING***

Both manufacturers and retailers understand this loss in value, but are trapped in a cycle by short-term concerns and a win-lose mentality. Manufacturers initiate trade promotions, which incur operational costs, in order to increase revenue, only to find their profits eroded by the lost margin and higher operations costs, forcing them to seek revenue in another trade promotion. Retailers have reacted in a rational manner, buying excess when the price is low and selling at a regular price, for so long that it is embedded in the culture and is critical to growth and profitability. Manufacturers and retailers are locked into a prisoner's dilemma in which both must agree to refrain from high-low pricing/forward buying in order for both to profit.

The efficient consumer response movement has been unsuccessful in halting the practice of high-low pricing/forward buying for manufacturers whose products lack strong branding or service differentiation. Even nationally recognized brands, such as Campbell's Soup Co, have been unable to weather the short-term effects of "de-loading" the trade channel in order to move from high-low to everyday low prices. Retailers have exhibited their disapproval of manufacturers' efforts to stop forward buying by de-listing manufacturers' products and the growing power of national retailers, like Wal-Mart, makes this a serious threat to even branded manufacturers.

### ***5.2 BREAKING THE CYCLE WITH DERIVATIVE MECHANICS***

In commodity markets, including stock exchanges, derivatives enable producers and purchasers to mitigate risk through the purchase of what amounts to price insurance. Instead of hoarding a commodity in order to insure a profit, traders buy or sell the option to buy or sell a certain product for a certain price by a certain day. This prevents wasteful excess supply chain expenses like large warehouses filled with inventory or large factories capable of producing an entire quarter's demand within the last week of the last month. Furthermore, these markets also enable speculators to gamble on the outcomes of prices, making the market more liquid for the "hedgers" (those mitigating risk) by their efforts.

Shifting from a trade promotion policy to the use of product based derivatives, such as call options on certain products, allows manufacturers and retailers to maintain the benefits of the existing system while leaving behind the expense of supply chain inefficiencies. A retailer can buy an option, up front, to purchase a certain amount of a certain product within a specified time period. The retailer gains a better price at a lower cost than storing the inventory, the manufacturer insures consistent market share and gains short-term revenue without carrying excess production or warehouse capacity. Finally, because the delay in moving inventory to the end consumer is removed, value to the end consumer increases, enabling the whole channel to profit further.

### ***5.3 OTHER APPLICATIONS OF FCPG DERIVATIVE MARKETS***

This paper indicates that a derivatives market based on food and consumer packaged goods could be instrumental in improving supply chain performance through reduced product lead times. Such a derivative market is likely to have other ramifications on the FCPG supply chain as well, possibly including the following:

#### **Improved Sales Forecasting**

While a smoother demand, unperturbed by promotion induced forward buying, would help to make sales forecasts more accurate, the prices of traded derivatives would also provide a strong indication of future demand. With retailers incented to better forecast end consumer demand in order to lock in the lowest possible purchase prices, derivatives prices should be a strong indicator of future demand. This improved sales forecasting is likely to result in lower safety stocks and improved customer service, potentially even enabling the reduction of capital assets.

#### **Pre-Funded New Product Launches**

Speculators and speculating retailers would be able to lock in purchases of specific new products, allowing the price to float freely until it reached market equilibrium. Manufacturers could finance these product launches with the revenue from the sale of these options.

#### **Benefit Sharing Opportunities**

One of the stickiest supply chain collaboration issues today is how to share the benefits of mutual improvements. With derivatives, manufacturers could encourage consultants or channel partners to help them to improve production processes or technologies by granting options to them.

#### **Capacity Buy Backs**

In the event that a manufacturer has an opportunity to sell a greater amount of a high margin product than was originally projected, it could buy back options on lower margin products in order to clear sufficient production capacity. By compensating them for lost sales, the manufacturer is less likely to alienate retailers.

### Dynamic Pricing

Based on capacity projections derived from outstanding options, manufacturers will be able to adjust price to reflect the scarcity/availability of manufacturing and distribution capacity. This price adjustment would extend not only to the spot price, but also to derivatives prices.

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