

Bullwhip Effect – A Phenomenon in Forecast Driven Distribution Models



Applies to:

SCM 4.1 onwards

Summary

In the times of global competition and networked economy companies that were once closed entities realized the importance of opening up by collaborating with their supply chain partners. This article discusses about Bullwhip Effect the most common phenomenon observed in forecast driven distribution models. The discussion is extended to understand the reasons for this phenomenon with suggestions given to counter the bullwhip effect.

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Introduction:

In the rapidly changing business environment where organizations are competing on a global scale, an effective supply chain is the only best way which helps organizations to stay ahead in the competition. The effectiveness of an organization's supply chain is measured by the overall supply chain profitability it generates across all the supply chain partners.

A supply chain cycle in which each stage calculates its demand based on the orders placed by their down stream partners and generates a forecasting model based on this information could face a serious threat of demand fluctuations. This distorts the demand information which creates oscillations and they get magnified as we move up the supply chain. This phenomenon is referred as Bullwhip Effect. Lack of coordination and inaccurate information flow between the supply chain partners are the root causes for this phenomenon

Bullwhip Effect Phenomenon:

Bullwhip Effect is most commonly seen in forecast driven distribution models. In these models each stage in the supply chain will have their own estimate of demand which results in a conflict in the orders placed to the supplier than sales to the consumer. This variance gets augmented at the higher end of the supply chain and causes huge demand fluctuations. This phenomenon leads to many detrimental results in the supply chain namely excessive safety stock inventories, high operational costs, and inefficient use of capacities.

Graphical Explanation for Bullwhip Effect:

Demand fluctuations mainly occur because of inaccurate information flow in the supply chain. Each partner in the supply chain network concentrates only on maximizing their local objective with out considering its impact on the entire supply chain. The phenomenon of bullwhip effect is explained graphically below

Stage -1: Consumer Sales at Retailer

This graph gives sales volume of a product at a retail outlet which can also be considered as consumer's demand for a particular product. A part of random increase in the sales volume projects a growth trend for the product.



Graph -1

Stage -2: Retailer's order to Wholesaler

The growth trend which is observed in the first stage is interpreted incorrectly by the retailer which would push him to order more than the observed increase in demand. This is only done with the intention to meet the future anticipated demand.



Graph-2:

Stage -3: Wholesaler's Orders to Manufacturer

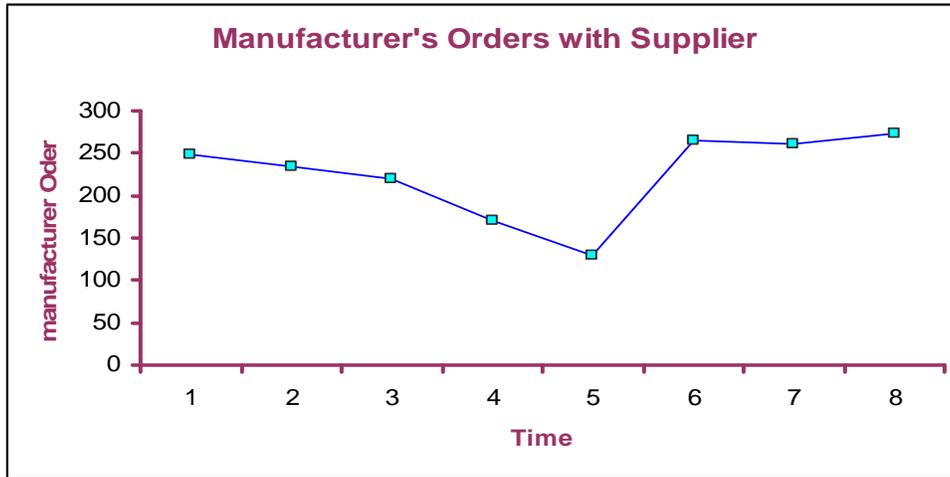
The wholesaler has no exact information from the retailer regarding a sudden increase in the order size and considers it as a growth trend for the product. This compels him to place an even larger order with the manufacturer.



Graph-3

Stage -4: Manufacturer's Orders with Supplier

A jump in the order size from the wholesaler gives a wrong signal to the manufacturer regarding the product demand and there by orders of larger size is placed with the supplier.



Graph- 4

The demand information got distorted as we went up the supply chain from the retailer to the manufacturer (Graph-5). A careful observation would reveal that this distortion is primarily due to inaccurate information sharing between the trading partners. Lack of trust based relationship between the partners is also another reason for this phenomenon to crop up. The following graph gives an overview of the quantity disruptions that occur along the supply chain leading to bullwhip effect.



Graph-5

Causes for Bullwhip Effect:

1) Inaccurate demand forecasting:

An order from a downstream player signals about the product demand and the upstream manager readjusts his demand projections and places an order accordingly. The upstream manager is completely unaware of the actual demand coming from the end consumer.

2) Order Batching:

Order batching is a practice followed by the companies to reduce their ordering costs and to take the advantage of transportation economies such as full truck load economies. Accordingly they place an order with their upstream organizations (suppliers) on periodic basis instead of frequent ordering. Hence the suppliers are faced with a sudden upstream of orders for a certain period and no demand for the rest of the periods. This periodic ordering amplifies and contributes to bullwhip effect.

3) Price fluctuations:

Special pricing policies like price discounts, quantity discounts and rebates etc lead to an increase in the variability of orders placed. An outcome of price fluctuations is forward buying where customers buy large quantities which do not reflect their immediate demand. This is done only to take the advantage of the special prices offered and they stop buying when product's price turn to normal till the inventory which was piled up gets depleted. This variation in the buying quantity is much higher than the consumption rate there by leading to bullwhip effect.

4) Rationing and Shortage Gaming:

When the demand for the product exceeds the supply the manufacturer often rations its product to customers. The rationing scheme would in turn force the retailers to inflate their orders for the product. This is mainly done to see that the partial shipments they receive would completely fulfill their demand. The buffer orders are cancelled later by the retailer. This scheme in turn rewards the retailer and the manufacturer is left with surplus of product.

5) Behavioral Causes:

Intention to achieve their local objectives will destroy the cordial relationship between the supply chain partners and turn them to be opportunistic at the expense of overall supply chain performance. There would not be any information sharing and the successive stages becoming enemies rather than partners.

Cracking the Bullwhip Effect:

Supply chain managers can effectively mitigate bullwhip effect by understanding the root causes of this phenomenon. The causes which were discussed above are tackled in the following way

1) Evade Multiple Demand Forecast Updates:

Each member of the supply chain performs their own forecasting based on the demand data they receive from their immediate down stream member. This repetitive processing of the consumption data leads to demand fluctuations which get amplified at the upstream side of the supply chain. This can be addressed by

- Providing the manufacturer quick access to Point of Sale (POS) data at the retailer outlet. Electronic data interchange (EDI) systems facilitate the quick access of POS information to the manufacturers.
- Responsibility of forecasting is given only to the upstream partner of the supply chain there by making all the downstream partners only passive members. This will address the issue of differences in the forecasting methodologies adopted by each member. The concept of Vendor Managed Inventory (VMI) would come handy in implementing such centralized multi echelon inventory control systems.
- Direct marketing channel where by all the intermediaries are eliminated would mitigate this phenomenon by reducing the long lead time as the manufacturer has complete information about the demand pattern. The philosophy of Just in Time (JIT) would be helpful in reducing the long lead times.

2) Order batching:

Small batches or more frequent ordering would help in handling this cause. EDI systems installed would counter the ordering cost associated with frequent orders. To enjoy the benefits of full truck load economies manufacturers are suggesting their distributors to order assortment of different products. The development of third party logistics helps in consolidating the orders coming from multiple suppliers located in geographical proximity. This way companies can realize the full truck load economies.

3) Rationing and Shortage Gaming:

The unproductive gaming practice during shortages can be avoided by allocating orders based on historic sales record. Sharing of production and inventory information by the manufacturers to the down stream members will also help in diluting the motivation for gaming. More stringent cancellation policies would alleviate the shortage gaming.

4) Price Fluctuations:

Bullwhip effect caused due to forward buying can be answered by reducing wholesale price discounts. The strategy of Every Day Low Pricing (EDLP) can be used instead of High -Low pricing. In case of using the sigh- Low pricing strategy companies have to design special purchase contracts where by the manufacturers can plan their production schedules effectively and buyers can enjoy their strategic buying practice.

Conclusion:

The optimizing behavior of the players involved in the supply chain would lead to bullwhip effect. A shift from forecast driven distribution models to demand driven distribution models along with exchange of inventory information between the partners and simple pricing schemes would help in paralyzing this phenomenon.

Related Content:

- 1) [Bullwhip Effect in Supply chain](#)
- 2) [Information Distortion in Supply chain](#)
- 3) [Cracking the Bullwhip Effect](#)
- 4) [Bullwhip Effect -Wikipedia](#)
- 5) [Managing Bullwhip Effect –Case Studies](#)
- 6) [Causes & Counter measures for Bullwhip Effect](#)
- 7) [Supply Chain Management – Strategy & Planning by Sunil Chopra and Mendyl](#)

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